73® Amateur Radio Today

APRIL 1996
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International Edition

The Arrow Corner Beam

Build:

440 Super J
10-6-2 Loops
Low Band Loops
A Tree Antenna?

Reviews:

TriField Meter
Arrow Corner Beam
Startek Counter
Isotron 80

Special Antenna

04
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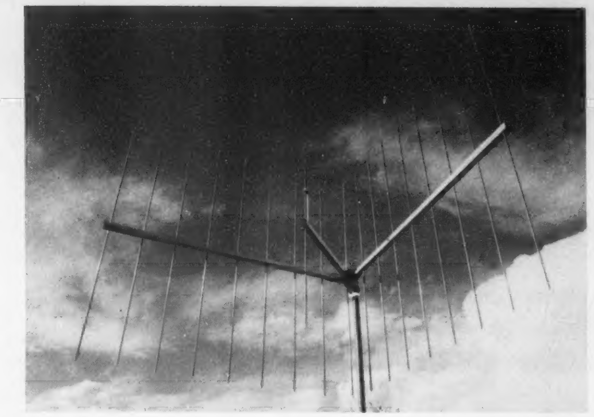
ICOM®

Corner Beam?

Big Forward Gain
Wide Backward Rejection
Exceptional Bandwidth
Compact Size



Your antenna makes all the difference at VHF and UHF—It determines transmitting range. It sets the limit for weak signal reception. And it decides what interference you'll hear & create.

An omnidirectional antenna radiates uniformly in all direction, and it also hears noise and interference from every direction.

A directional antenna not only sends your signal where you want, it hears the signal it's pointed at, rejecting others.

Gain really counts when you have to reach out across large distances to make contact. It also lets you operate with minimal power and cuts the interference you inflict on other stations.

Directionality is desirable in high activity locations. A clean sharp pattern without sidelobes or spikes reaches past the noise and interference to get the message through. Wide rear rejection lets you null out strong nearby signals to reduce interference.

CornerBeam vs. Yagi

When you want to contol your signal, think CornerBeam, not yagi. Take a look at what CornerBeam will do:

- 10 dB gain vs. dipole
- 40 dB Front-to-Back
- 60 degree Half-power Beamwidth
- SWR <1.1:1 across the band
- No dimension over 4 ft
- Mounts directly to mast or tower
- No need for offset or side mount for vertical polarization
- Vertical or horizontal polarization
- weighs only 10 pounds

Make the comparison with a yagi. A yagi with the same gain would have a boom 10 feet long. And yagi bandwidth would beless than half. Unlike a yagi, CornerBeam's pattern has no unwanted spikes or bustles to the side or behind.

Symetrical Pattern

CornerBeam's gamma match is engineered to be in-line rather than displaced from the element axis. The result is a distortion-free measured pattern that is precisely equal on each side of the antenna center line.

Bandwidth Counts

With its exceptional bandwidth, your CornerBeam can be put to work right out of the box without special tweaking. It can serve you now when you're working repeaters with an FM handheld, and later when you go after small signal DX at 144.05 or set out to work satellites.

CornerBeam can still be your beam when you join MARS at 143/148 MHz, team up with the Civil Air Patrol to locate downed aircraft at 154 MHz.

Scanning Too?

CornerBeam's directionality and gain extend your monitoring range on public service, marine, and aircraft frequencies.

CornerBeam for Repeaters

If your repeater shares a frequency with another, the deep wide null toward the rear could keep your signal out of the neighboring repeater's receiver and turn a deaf ear to its signal. A pair of CornerBeams can be combined to privide special radiation footprints. A CornerBeam aimed at an area your repeater hears poorly could improve service where incoming signals from HTs are presently too weak. CornerBeam makes it possible to increase repeater density while reducing interference.■

Corner Beam Models

Band	Max Dim	WindLd	Price
2 meters	4 ft	<2 sqft	$145
220 MHz	4 ft	<1 sqft	$145
70 cm	3 ft	<1 sqft	$115
Dual 146/435	4 ft	<3 sqft	$165

Construction: Aircraft aluminum. Booms are square. Elements are solid rod. Stainless hardware included for tower and mast mounting accepts up to 1.5" dia. mast and may be rotated for vertical or horizontal polarization. Connector is SO-239 for VHF, N female for UHF. Dual-Band antenna has separate driven elements, both with N connector.

Dimensions given in table are for reflector booms and reflector elements.

Options: Commercial Frequency $45.

Duplexer: Add $80 for VHF/UHF Duplexer and cabling for single coax feed of Dualband 146/435 Corner.

Shipping: UPS ground to continental USA ($11 S&H). Air Parcel Post to HI, AK, & Posessions ($14 P&H). Canada ($16 P&H).
Allow 2 weeks for delivery.

Can You Find theTiger'sTail?

If your eyes are sharp you can spot the **TigerTail**™ in the photo above. It puts extra growl into the signal from the Hand Transceiver it's attached to.

TigerTail™ improves SWR, lowers radiation angle, and extends range. You can use low power and save your battery pack, but still have a big signal.

Better than an amplifier, it improves reception too. **TigerTail**™ does all this by simply slipping under your flex antenna and just hanging down. It doesn't stick up or out or get in the way. It's the simplest way to boost your signal.

☐ **Yes, I want Performance in My Corner!**
___Send my CornerBeam: __2m, __220MHz, __70 cm, __Dual 146/435.
___Options: __DualBand Duplexer, __Commercial/Marine Frequency:_____
___Send my TigerTail. (1 for $7.95, 2 for $15, 3 for $21. Specify band.)

☐ **Yes, I circled the TigerTail! Knock $5 off my order.**

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LNG-(*)

still only $59
wired&tested

FEATURES:
- **Very low noise:** 0.7dB nf vhf, 0.8dB uhf
- **High gain:** 13-20dB (depends on freq)
- **Wide dynamic range** - resist overload
- **Stable:** dual-gate GAS FET

**Specify tuning range: 26-30, 46-56, 137-139, 139-152, 152-172, 210-230, 400-470, 800-960 MHz.*

LNW-(*)
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- **Small size.** Only 5/8"W x 1-5/8"L x ¾"H.
- Nf 1.2dB vhf, 1.5dB uhf.
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**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.*

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Helical resonator filters may **reduce your intermod & cross-band interference.**

MODEL HRF- (*), *$59 vhf, $99 uhf.*
**Specify tuning range: 136-140, 142-150, 150-162, 162-174, 213-233, 420-470.*

REPEATER CONTROLLERS

NEW **CWID-2.** Eprom-controlled, miniature, easy to build, low power CMOS, (specify call) .... **only $54 kit, $79 w/t**

COR-6. COR & Real Voice ID on one board. Digital ic records up to 20 seconds of your voice. Can record multiple id messages. Tail and time-out timers, courtesy beep, solid-state relay to key transmitter.
....**kit $99, w&t $149**

COR-3. COR, timers, court.beep .... **kit $49**
CWID. Diode programmable .... **kit $59**
COR-4. Complete COR and CWID all on one board. CMOS logic for low power consumption. EPROM programmed; (specify call) ....**kit $99, w&t $149**

ACCESSORIES

DVR-1 DIGITAL VOICE RECORDER. Records up to 20 sec. of your voice with built-in mic. or external mic. Terrific as voice ID'er for repeaters or fox hunt xmtr, contest caller, radio notepad, etc. Extensive manual tells how to use multiple messages adapt to many applications. ......**kit $59, w&t $99**

TD-4 SELECTIVE CALLING MODULE. Versatile dtmf controller with 1 latching output. **Mutes speaker until someone calls** by sending your 4-digit tt code. Or use it with a **long tt zero** digit to alert anyone in club for emergencies. Also may be used to **control autopatch or other device**, like TD-2 except only one output. ....**kit $49, w&t $79**

You Can Win $50!

Building your own gear is one of the most interesting things you can do in amateur radio! Now you can win a $50 credit toward any Hamtronics® kit just by explaining how you or your club has used a Hamtronics® kit in an interesting or novel way. The winning letters will be featured in future Hamtronics ads.

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It's one thing to read an article about ham satellites and another to do it yourself. That's where excitement comes in, when you have the spirit of adventure. Here's your chance to get other hams involved and help them share your fun.

Send your letter(s) to "Winners", c/o Hamtronics, Inc., 65 Moul Rd, Hilton NY 14468-9535 or fax 716-392-9420.

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A fully microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

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w&t still only $1295
50 & 900 MHz bands slightly higher
- Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.
- **FCC type accepted** for commercial service in150 & 450 bands. *(Request catalog for details.)*

REP-200T Voice Message Repeater. As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be **remotely recorded off the air.** Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!**..........................**adds only $100!**

REP-200C Economy Repeater. Uses COR-6 Controller (no DTMF control or autopatch). Features **real-voice ID.** ....**Kit only $795, w&t $1195**

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XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

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FM EXCITERS: 2W continuous duty.
FCC type accepted for com'l bands.
- **TA51**: 50-54, 143-174, or 213-233MHz.
- **TA451**: 420-475 MHz . *New low price!*

Either model: ....**kit $99, w/t $169.**
- **TA901**: 902-928 MHz, (0.5W out);

New low price!........................ **w/t $199.**

VHF & UHF AMPLIFIERS.
For fm, ssb, atv. Output levels from 10W to 100W. **Models starting at $99.**

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- **R451 FM RCVR**, for 420-475 MHz. Similar to above. *New low price!* **kit $129, w/t $189.**
- **R901 FM RCVR**, for 902-928MHz. Triple-conversion. *New low price*.... **$159, w/t $219.**

NEW **R150 MONITOR RCVR** for 143-164 or 216-225 MHz. 4-channels. Great for monitoring repeaters, amateur calling frequencies, packet radio, commercial two-way radio, police/fire frequencies, or weather forecasts. **Good starter kit**, easy to assemble and align........**kit only $99, w/t $189.**
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Join the growing ranks of amateurs who get striking images directly from the weather satellites! We used our 30+ years of experience in designing high-quality vhf receivers to bring you a new enhanced version of our long-popular WeSat receivers. The new R139 is a very sensitive wideband fm receiver optimized for amateur reception of NOAA APT and Russian Meteor weather facsimile images on the 137 MHz band. Use with any popular demodulator and software. Covers all five popular satellite channels. Scanner circuit and recorder control allow you to automatically search for and tape signals as satellites pass overhead, even while away from home.
- **R139 Receiver Kit less case** **$159**
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- For complete info, call or write for free catalog. *(Send $2 for overseas air mail.)*
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**See Safety Notice on page 88.
Very Important!**

On the cover: This Corner Beam from Arrow Antenna is reviewed on page 24 by WB9RRT (CB 148/450 Dual-Band Corner Reflector). These antennas are distributed by Antennas West.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

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Contract: Even the most cursory glance at this text is sufficient to bind you, morally and legally, to take a kid (or kids) along on Field Day, get 'em fired up on amateur radio, and then help 'em get started toward a license. You'll feel good about yourself and our legal cousel won't have to hassle you.

THE TEAM

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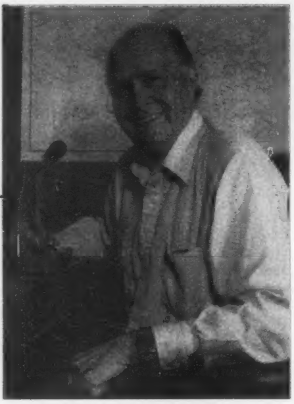

Priorities

A letter from a reader who is embroiled in a pissing contest with a crusty old ham asked my advice on how to handle the situation. Though he will probably ignore me, being caught up in the emotions of his windmill tilt, I suggested it was time for him to sit down quietly somewhere and think over his priorities. With spring here…a time of awakening and renewal…maybe you could do worse than shut the shack door, turn off the rig, and spend some time thinking.

What do you want to do with your life? What goals have you in life? Do you hunger for recognition and honors? Money? Do you have a need to leave the world a little better for your having been here? How about your children? They are one of the best investments you can make for posterity, unless you neglect them in pursuit of short range goals. Is your family being fed right so they'll be able to live long, healthy, and productive lives? Do you even know what they should be eating? How much have you read about that?

Sure, amateur radio is fun. But so are computer games, playing chess, going to the movies and bowling. There are an almost infinite number of ways to have fun that do little or nothing to help you or your family to grow. I've used amateur radio as a way of learning as well as entertainment. It got me to go to a tech college, then into the Navy as an electronic technician, where the school was superb. But I didn't get on the air and vegetate. I was quickly experimenting with VHFs. My first ham contact was with a 2-1/2m walkie-talkie I built from an article in *Radio*. Then I discovered RTTY and helped put an RTTY repeater on top of a NYC skyscraper in 1949. The next thing you know I was doing an RTTY newsletter, then a magazine on the subject. When NBFM was invented I was one of the first using it in 1946. And so it went with SSB in 1954, SSTV in 1968, my own repeater in 1969, and so on. I've never vegetated in ham radio.

Give your life some thought and try to take a long range look at it. What can you accomplish with the time you have left? Is being just another cog in the wheel enough? Do you really want to spend your life on petty quarrels with idiots? If so, why not get into politics?

In my editorials I've been trying to get you to open your horizons. To read, learn, understand the world, and help me move it ahead. I feel I've been successful in pursuing my goals. I've helped just a little to bring the world cellular telephones, computers, and better music. Now it's cold fusion, which will be the greatest gift I'll ever be able to give the world by far. Sure, all of these things would have happened without me, I'm sure. But my minuscule pressure has helped. No, I haven't gotten many honors. But I haven't hungered for 'em. No "Ham of the Year." Etc. But I have helped thousands of my readers to have better lives, and I don't think I've caused anybody to have poorer lives for having read my magazines or even for having worked for me.

With the millennium coming in four years, why not take a few minutes to re-focus your life. Think about your wife. Your kids. What can you do that will make life better for them? How about your business or the people you work for? What can you do or study that will help them and you? What new skills can you build? Are you working at a job that is more fun than work? So why not? Is it worth your time and effort to learn about nutrition so you and your family can live to 150 and be healthy and productive every day of your lives? Are you using amateur radio as a way to have fun while you are learning? Or are you a vegetating curmudgeon? Is working a new country more important than helping your children to grow? Is that 75m net more important than taking your wife out to dinner and a movie? Or maybe planning a surprise trip somewhere for a weekend?

Are you stuck up on some 2m repeater for life? I feel so sorry for the no-coders who are not using the key to fun and education they have in their hand. No, not the CW key, it's the key to packet, satellites, slow scan, and so on. I feel sorry for the thousands of hams living out their remaining days on 75m nets, or fighting pileups and queuing up for DX lists. Amateur radio should be a key to fun and education, not an end in itself. Lift your eyes from this page and stare out the window. It's a big world out there and it's in desperate need of help. Help *you* could provide.

Our school system is awful because you let it get that way. Ditto our medical industry. And crime, drugs, and so on. When people work for me one of the first lessons is to erase the whole concept of "that's not my job." The bad language on our bands *is* your job. The Techs stuck up on 2m because no one has pushed them to upgrade *is* your job.

Small business is the real power of America, not the *Fortune* 500 giant business cartels you've meekly let get control. With the help of Limbaugh we've started flushing the crap out of Congress, but if you re-elect any incumbents you're partly responsible for the proliferation of drugs, crime, the bulging bureaucracy, and so on. Never Re-elect Anyone (NRA) is my bumper-sticker slogan. Get those greedy old Byrds out of congress.

Continued on page 25

ASTRON CORPORATION

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MODEL VS-50M

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- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

- LOW PROFILE POWER SUPPLY

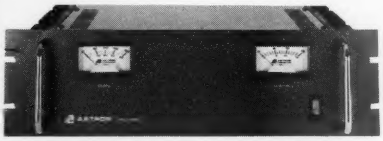
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES

MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	Continuous Duty (Amps) @10VDC	Continuous Duty (Amps) @5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

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LETTERS

From the Ham Shack

Klaus Wolter N8NXF. Wayne, what's this noise I read in your editorial about a motor/generator perpetual motion machine? I doubt there is any magic involved. I have not looked at the patent but will poke a guess. You mentioned that this motor/generator claims an input power of 19.55 watts to run as a motor and that the generator puts out 62.16 watts. I'm sure it can, but I'll bet you it can't do it at the same time! I bet the electric vehicle (scooter) you rode was powered by a battery whenever it required energy to accelerate, chug up a hill, or maintain speed. When it is time to slow down or come to a stop, the motor controller dumped that energy by running the motor as a generator and recharging the battery. This is nothing new in EV circles and is commonly used. It's called regenerative braking. A net excess of energy however cannot be produced by such a system. The high density magnet Takahashi developed, among other things, can make for smaller monor/generators. A problem with regenerative systems is that it is possible to demagnetize the magnets in the motor if one tries to generate too much power while running it as a generator. These magnets seem to be more immune to this when I consider the generator output/motor input ratio. I enjoy your editorials. Keep it up! *(Klaus, I'm suspicious of any claimed over-unity devices, so I'll be watching to see where the catch is. With the cold fusion effect now seemingly coming from the transmutation of elements within the metal lattice rather than zero-point energy or any other over-unity systems, it seems on firmer ground. Wayne)*

Marion Kitchens K4GOK. I do enjoy your editorials. And I agree with about 95% of your ideas, thoughts, comments. As a professional working for your government, I use many of the same techniques you do when trying to get people to use their brains! It is sometimes a real challenge, sad to say. Anyway, don't let up -keep on keeping on. There was a delightful change in the February issue of the magazine, specifically on the "Table of Contents" page. No, I did *Not* read that part about "The merest glance.......... Not me — no way will I enter a contract like that! Ha, Ha, Ha! Seriously, it is good to see the perky, humor shown therein. Maybe that means a positive, energetic bunch around the editors' desks. I hope that is the case.

Give the article by W6IOJ a "G" rating. It brings back some of the things I think are important to, but missing from, our hobby. Namely, showing people how to achieve good, positive results by hands-on experience with easy, simple techniques. In my humble opinion, that is a great article. See if you can find more like it for future issues. I for one, will read 'em all. *(Thanks! And congratulations on only being wrong 5% of the time. Wayne)*

John Clark KA2ZPM. Many hams with cataracts or whatnot will appreciate your almost total conversion to Roman type and the leading. Good job on the January issue. Wish you many ads in '96. *(Tests have always shown that serif-style type (such as Times-Roman) are much easier to read than sans-serif type. And that increases the comprehension and retention of the material. But artists, who are unconcerned with type readability, prefer the more beautiful sans-serif type (such as Helvetica). Anyway, glad you approve. Now, if we can only get our photo scans to look better! One more thing, I'll have to write about this, but according to Dr. Wallach, who is a Nobel nominee, cataracts are purely a mineral deficiency disease. If you get the minerals your body needs your eyes will do just fine. Wayne)*

Arthur Harris KC6WZJ. It appears to me that you are overlooking an excellent business opportunity. As you close down *Radio Fun* you should start a new magazine called *No Code*. In fact you should close down 73 also, since the numbers indicate that 73 is aimed at a minority audience. The new magazine would encourage the no-code majority to form their own radio clubs and pursue their own agenda. Of course, the first two things on that agenda would be to petition the FCC to eliminate the code requirement in amateur licenses and the other would be to recognize that the keypounders are **the enemy**. Their interests are not our interests. Lest the keypounders get upset, they should remember it is their mandate that puts the majority of amateurs in the back of the bus. Us po' no-codes just gettin' tired of the small back of the bus with all you minority folks up in the big front of the bus. Maybe its time for a little affirmative action.

You get many club newsletters. How many conduct code classes? I have visited a few and none gave code classes. Theory but no-code! If code was God's gift to mankind, as asserted by the keypounders, it seems to me that they would be falling all over themselves to give classes and enlighten the po' unwashed no-coders.

Sitting here in the back of the bus, gazing forward to the keypounders and especially towards those Big Daddy 20 wpm types, I'm struck with an observation. How come these people will talk on HF with foreign no-code amateurs, but will not do the same for American no-code amateurs? Talk about bogus! I guess honest keypounder is an oxymoron after all. The majority of material in 73 deals with areas which are forbidden to me as a no-code amateur, thus I wouldn't dare comment, lest it offend my betters. I'll give "Kill Your Interference" at least 10 G's. *(Art, I have so many economic opportunities I don't know which way to turn. I could have turned Radio Fun into a no-code rag and made big bucks. I think CQ is doing that. But then their editor is still a Tech, after all these years. But shame on you for fanning the flames of religious intolerance, the code being a religious matter, not one of reason. While I think the code test is a stupid hangover from antiquity, I have no sympathy with anyone who is too lazy to learn it. If they use my method almost anyone can learn to copy 13 or 20 wpm in a few days. Or you can use the ARRL and other systems and take a year or so of frustration and sweat. I went that route, so I know how awful it is. The few clubs that have code classes are teaching to old slow system, so stop fussing about that. You don't need a club, all you need is a couple of my code tapes and the gumption to actually use them for a few hours. Tens of thousands of hams have used my method and zipped right through, so don't come whining and sniveling to me about how the code is an obstacle ... Wayne)*

Bed Hodgins, Riverton NJ. First some background information about myself. I'm sixteen years old and I'm a sophomore in high school. I don't have a ticket yet, but I sure would like one.

Just a few thoughts before I say what I'm really writing for. I don't have a subscription to any ham radio magazines. About the only time I get one is when I have a few extra dollars in my pocket. I invariably get *73* because I enjoy reading your columns. So much of what you say needs to be said more often. Especially in the December's issue. Your view on the minimum wage is right on. You are the only person that I know of who's saying those things. Hopefully your words on that subject will show a few people "the light."

What I really wanted to write about concerns the issue of recruiting new hams. It seems that the hobby is losing more hams than it is replacing. This is something that you are concerned about. I've been very interested in ham radio for five years now. Part of the reason I haven't gotten my ticket yet is that I haven't found a VE to give me the test. But that is only part of the reason. At first I was scared of the code. I'd spent time trying to learn it, and never succeeded. When the FCC announced the no-code Technician license, I decided to go that route until I could conquer the code. The other reason I've not taken the step is my lack of a mentor. You see, unlike all these young kids and who have hams in their family going all the way back to Tesla, my father is not interested in ham radio. If I do happen to get my license and maybe some day a radio, he'd be glad for me, but he's not going to go too far out of his way for me.

One of the remedies to my first problem (the code) is your solution—"To he— with the code." Another of the remedies is for older, more experienced hams to take a greater interest in recruiting new hams. Most newspapers have a section that lists community events. It would take all of ten minutes to call

Continued on page 15

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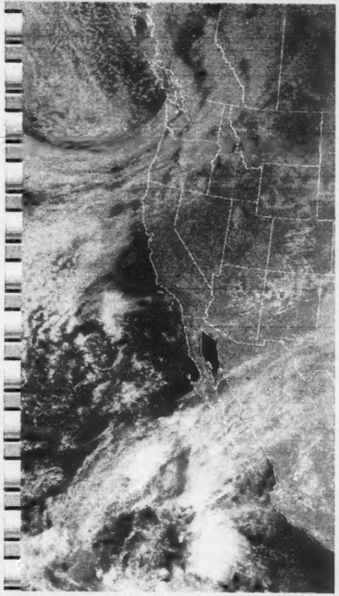

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RG58A/U Strd Center Cond. 95% TC Braid	.17/ft	.15/ft
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1418 8/Cond. (2/14 6/18) Blk UV Res. Jkt. Rec. up to 300 ft	.47/ft	.45/ft
18Ga. Strd 4/Cond PVC Jacket	.20/ft	.18/ft
18Ga. Strd 5/Cond PVC Jacket	.22/ft	.20/ft
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FleaSpeak 101

With Dayton and a host of smaller hamfests coming up this spring we thought it might be a good idea to brush up your vocabulary so that you understand what those well-meaning hams on the other side of the flea market table are saying. Here is a translation guide that we pulled off a USENET amateur radio news group.

"This rig puts out a BIG signal!" (The rig flat-tops and distorts so badly, your signal will be at least 50 kHz wide!)

"This rig will bring back the feelings and atmosphere of vintage ham gear." (The bypass capacitors to the AC line put enough voltage on the chassis to give you a shock in the lips through the microphone, and it smokes so much when you turn it on that you'll probably start coughing and wheezing.)

"The transmitter is outstanding." (It doesn't receive.)

"I just aligned it." (All the slugs on the transformers are now snugged down tight.)

"This is the rig of my dreams. I really wanted one of these as a kid, but now (snuffle) I've got to let it go." (As I've gotten older, I've learned what a hunka junk it is.)

"It worked last time I used it." (And if it still worked I'd still be using it.)

"Real popular rig in its day." (Yeah, there were whole HF nets on the repair and maintenance problems.)

"I'll help you carry it to the car." (I'll do anything to unload this boat anchor.)

TNX to Dave W9GR and all the others that contributed to this post.

Tampa Museum Pays Off!

Robert and Janice Miller and their two sons, Frank and James, visited the Museum of Science and Industry in Tampa FL about two years ago. Everett Hale KA4IZQ showed them what ham radio was all about at KE4ZRS, the museum amateur radio station. The Millers, from La Belle FL, were so impressed that they decided to become ham radio operators. Within two years Robert obtained his Advanced Class license, his 16-year old son Frank got his Extra Class ticket (AD4RD), his 14-year old son James got his Advanced Class ticket (KE4PQH), and his wife Janice got her no-code Tech ticket (KD4ZIX). Have any other museum stations won us converts? No reports of such, so presumably not. TNX Clark Evans WA4DLL for the news.

What a place to blow a fuse

German cosmonaut Thomas Reiter DF4TR/DP0MIR, aboard the Mir orbital complex, reports that a power supply used for some of the spacecraft's ham radio equipment failed on New Year's Eve. The remaining older power supply is only capable of powering the old Icom 2-meter transceiver and one 1200-baud TNC. The digital voice module also has failed, so there will be no more automatic voice recordings in the near future. Reiter reports all four fuses in the two connected transceivers have blown and only two spare fuses remain. Last month, Reiter used the digital voice recorder, built by Thomas Kieselbach DL2MDE to broadcast holiday messages. The primary transmitting frequency is 145.800 MHz. Recently, the cosmonauts on Mir unpacked new amateur radio equipment delivered by rocket, including a 70-cm FM transceiver and 9600-baud packet gear. Reiter was philosophical. "Well, at least we can be reached and still can talk with the world," he said in a message to Dave Larsen N6JLH.

TNX W1AW bulletin ARLS001

How's Your FIST?

Just got your Novice or Tech-Plus and want to give CW a try? (After all, you did put all those hours into code tapes and they say the best way to build up speed for that General is on the air.) Check out FISTS CW Club. Our Tech Editor N1VXW after a very long CW QSO with Ken Coughlin KF8RG was sent a QSL and an application to FISTS. The CW club is the membership organization of the International Morse Preservation Society, a club dedicated to keeping CW alive, well and fun on the amateur bands. While Morse may not be everyone's cup of tea, FISTS is dedicated to helping Morse be a pleasurable experience for those inclined to try it.

FIST organizes high and low speed nets on a weekly schedule, provides QSL Bureau services and there's even a number you can call to "Dial-A-Sked" so you can make that first CW contact less nerve-racking. The organization was founded in England in 1987 and has a North American branch. If you're a newbie to CW or have been pounding brass for longer than you can remember it just might behoove you to get in touch with Nancy WZ8C, the North American Representative of FISTS. She can be reached at: PO Box 47, Hadley MI 48440-0047, (e-mail 73631.3654@compuserve.com).

CONGRATULATIONS
LARRY AND JO
1960-1995
Anniversary Issue

Another Milestone

Larry N8GZW and JoAnn Brauneller of Ohio celebrated their 35th wedding anniversary October 22, 1995. Adding to the festivities was Keith Berning KC0WL, who presented his parents-in-law with a commemorative copy of *73*'s 35th Anniversary issue. Congratulations from all of us to this ham family! (Photo by Keith Berning KC0WL.)

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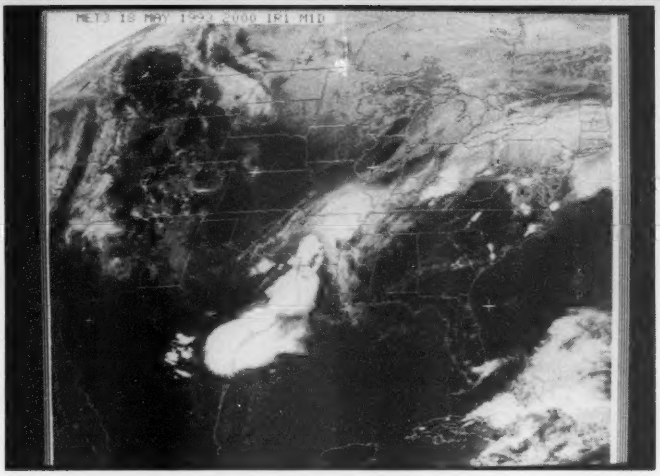

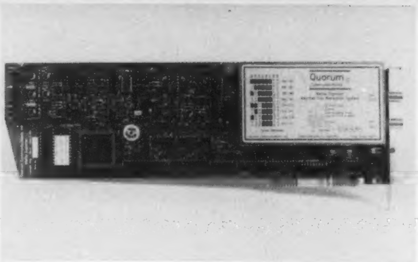

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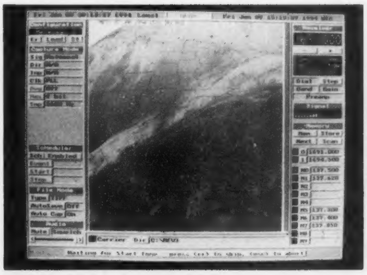

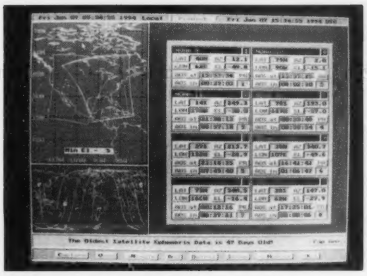

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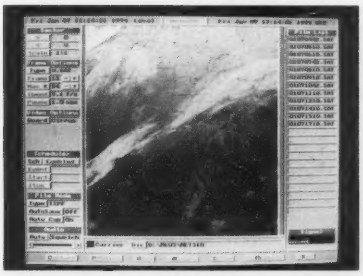

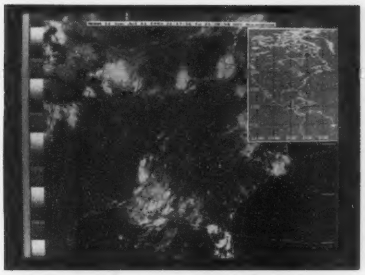

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CIRCLE 257 ON READER SERVICE CARD

Number 10 on your Feedback card

440 Super J-Pole Antenna

Here's a great club project!

Marty Gammel KA0NAN
1703 Hewitt Avenue West
St. Paul MN 55104-1128

Why pay commercial prices for a UHF antenna you can build at a fraction of the cost? Here's a great antenna you can build for less than $7 (at current prices). Even better, once you have all the materials in hand, it should slip together in less than an hour. Then you can brag that you "made it yourself!"

> ***"They have almost 6 dB of omnidirectional gain, and don't have that crummy lobe shooting up toward passing aircraft that a well-known commercial antenna suffers."***

I love J-pole antennas for the VHF and UHF bands. They have almost 6 dB of omnidirectional gain, and don't have that crummy lobe shooting up toward passing aircraft that a well-known commercial antenna suffers. They consist of a vertical quarter-wave antenna, with a half-wave mounted above it to provide gain by concentrating the radiation in a narrow vertical lobe.

Building the antenna

First, clean the areas of the tubing that will be soldered. Use a scrubbing pad or fine emery paper to get good, long lasting solder joints, since clean mating surfaces are very important. Clean the 3/16" tubing at this time, too. Clean *all* the copper with a solvent such as lacquer thinner or acetone and a rag, and do it in a *well ventilated* area. You don't want to inhale any of that stuff!

Lay all the half-inch copper sections out and apply flux to each piece to be soldered. I use a paste flux and apply it to the tubing, giving a twist as I assemble each piece to the next one to spread the flux around the whole joint. It helps to set a weight across the 19" and 6" pieces to keep them parallel during the soldering process. Measure the distance between these at the top and bottom of the 6" section to make sure that they are equally spaced. This is the tuning section of the antenna. Be generous with the flux; it helps clean the surfaces, as well as helping solder flow with less overheating and discoloring of the copper tubing. Any excess flux can be cleaned up using a rag and solvent after the soldering is complete.

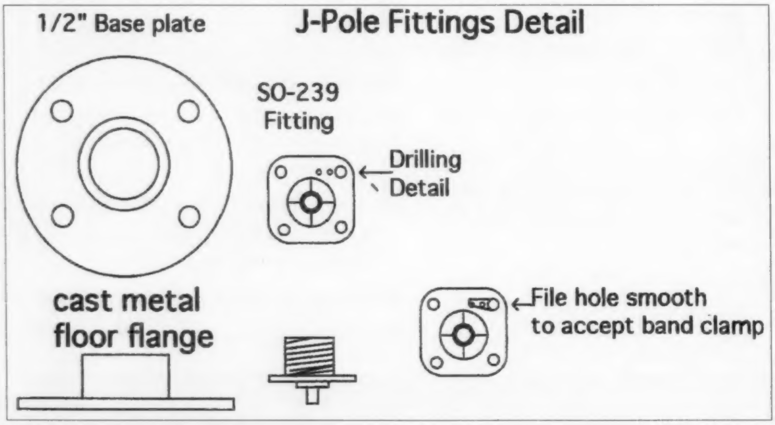


Fig. 1. Construction details.

Install the 12" wood dowel insulator between the upper and lower vertical sections. Form the 1-1/8" by 2-1/4" piece of sheet metal to make a heat shield to avoid burning the dowel. Next, drill a 3/16" hole about 1/8" in from the upper end of the lower section of the half-inch copper tubing and dowel, and do the same with one end of the upper vertical section of the copper tubing and the dowel. Bend the 3/16" tubing to form a very tall "U" shape and insert the ends into the holes you have just drilled.

You can start soldering at either the elbow or the threaded fitting, heating the copper ahead of the torch by allowing the angle of the flame to preheat the next joint. Solder all the lower joints and the "U" matching section first. Allow these to cool before you solder on the end caps. After the copper has completely cooled, clean the flux off all the solder joints using solvent and a rag or paper towel. Then, with a clean rag and solvent, completely clean the entire antenna. Once the solvent has evaporated, spray at least two coats of an exterior clear finish on all the surfaces of the antenna to keep it looking new.

Apply caulking or silicone to the dowel insulator and wrap this area with electrician's tape. It won't hurt to apply a coat of the exterior finish to further seal this area.

Tune *any* antenna with your Automatic Tuner!

MFJ greatly extends matching range of your Automatic Antenna Tuner -- you can match ANY antenna automatically! No pre-tuning, no manual tuner needed . . .

NEW

MFJ-914

$59.95

Does your automatic antenna tuner have limited matching range? . . . **Can't** auto-tune your antenna on all bands? . . . **Have** to pre-tune your antenna with a manual tuner?

MFJ's latest innovation greatly extends your automatic tuner's matching range. Now you can match nearly any antenna automatically!

MFJ's new *AutoTuner Extender™* transforms your antenna impedance -- up *or* down -- by as much as 10 times! *Puts nearly any antenna into the matching range of your automatic tuner.*

It's easy to use. Just bypass your automatic tuner and turn the MFJ-914 knob for minimum SWR. *That's it* -- you're ready to auto-tune. *Never manually pre-tune with an external tuner again!*

Extend your power range by transforming your antenna impedance so your tuner can be used in a higher power low Q mode.

Also extends *manual* antenna tuners.

You can use any transceiver from 160 through 10 Meters with up to 300 watts.

An OFF position protects your transceiver in two ways -- connects it to an external dummy load *and* grounds your antenna to bleed off static

The MFJ-914 is a heavy duty, wide range impedance transforming device. It has been very carefully designed for flattest frequency response and lowest loss.

Tune up your antenna *without* transmitting!

NEW

MFJ-212

$79.95

New MFJ-212 *MatchMaker™* lets you tune up your antenna tuner *without transmitting a single milliwatt!*

You can't cause QRM -- there's no power radiated .

You can precisely tune your antenna tuner for minimum SWR -- no additional "tweaking" needed when you transmit.

Protect your transceiver and tuner. Avoid dangerous overheating and arcing caused by high SWR and long tune-ups.

It's easy to use. Plugs between your transceiver and antenna tuner. Adjust your tuner for a null in receiver noise by ear or S-meter and you have minimum SWR!

Tuning noise is pulsed for easy nulling.

What if you accidentally transmit? Will you burn up your MFJ-212? *No!*

MFJ's exclusive *RF*Guard™* automatically bypasses your MFJ-212 to prevent damage.

Works with all transceivers from 160 through 6 Meters .

Use 9 V battery, 9-12 VDC or 110 VAC with MFJ-1312B, $12.95. 3 1/3x1 1/4x4 in.

MFJ 6 Meter Antenna Tuners

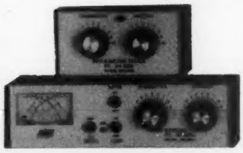
NEW

MFJ-906

$79.95

MFJ-903

$49.95



MFJ's latest antenna tuner for 6 Meters handles 100 watts FM and 200 watts SSB PEP. It works with all solid state and tube rigs and is perfect for your home and mobile stations.

You'll get low SWR with practically any coax fed antenna -- mobile whips, dipoles, verticals, vees, random wires, verticals, beams.

The MFJ-906 features a lighted Cross-Needle SWR/ Wattmeter with an On/Off lamp switch. You can simultaneously read SWR, forward/reflected power in 300/60 or 30/6 watt ranges.

A bypass switch lets you bypass your tuner and connect your transceiver directly to your antenna.

Measures 8x2 1/2x 3 inches. Lamp uses 12 VDC.

MFJ-903, $49.95. Same as MFJ-906 but less SWR/Wattmeter and bypass switch. 5x2 1/2x3 inches.

Magnet Mount *Super*Gain™* 2 Meter/440 MHz Antenna

NEW

MFJ-1729

$29.95

MFJ's *Super*Gain™* dual band antenna is ham radio's *highest gain* magnet mount mobile antenna!

You get a whopping 6.3 dB on 440 MHz and 2.6 dB on 2 Meters *for extra long range.*

Perfect for your dual band mobile *and* handheld. *Free* BNC adapter for your HT.

MFJ's exclusive 29 3/4 inch stainless steel *Slim Line Radiator™* minimizes wind vibration for less SWR flutter -- gives you longer range and better readability. 12 feet coax. Handles 170 watts.

Glass Mount *Dual Band* 2 Meter/440 MHz Antenna

NEW

MFJ-1734

$39.95

This new MFJ *glass mount* dual band antenna gives you a whopping 6.3 dB on 440 MHz and 2.6 dB on 2 Meters *for extra long range!*

It's easy to install.

MFJ's unique mount lets you adjust radiator for angled surfaces -- no tools needed. Radiator is easily removable -- prevents damage to antenna when you wash your vehicle.

A small inside counterpoise lowers SWR and makes tuning easy. Tuning tool included.

It's perfect for your dual band mobile and handheld. *Free* BNC adapter for handheld.

MFJ's exclusive 26 inch stainless steel *Slim Line Radiator™* minimizes wind vibration for less SWR flutter -- gives you longer range and better readability. Handles 50 watts. Includes 12 feet of coax, cleaning pad, mounting hardware.

1.8-60 MHz *Cross-Needle* SWR/Wattmeter

NEW

MFJ-860

$39.95

This new MFJ *Cross-Needle* SWR/Wattmeter covers 1.8-60 MHz for an incredibly low $39.95.

You can read forward and reflected power and SWR *simultaneously* at a single glance!

Push-button selects two *individually* calibrated power ranges -- 30/300 watts forward or 6/60 watts reflected. Has meter light, uses 12 volts.

All-metal cabinet has tough vinyl cladding that won't scratch or chip. You won't find a tougher, longer lasting finish anywhere. 4 1/2x2 1/4x3 inches.

MFJ 1.5 to 250 MHz *Dip Meter*

NEW

MFJ-201

$119.95

MFJ solid state dip meter covers 1.5 to 250 MHz in 6 bands. Thumbwheel tuning knob is color-coded to plug-in tuning coils. Earphone jack, sensitivity control, battery check function. Uses 9 volt battery. Measures 2x2 1/2x7 inches.

Add *brick wall* DSP data filtering to *any* multimode!

NEW

MFJ-781

$129.95

Add "brick wall" DSP filtering to any TNC or multimode data controller. Copy signals buried in noise and QRM -- *signals you can't even hear!*

Under severe QRM, DSP greatly improves copy of Packet, AMTOR, PACTOR, GTOR, Clover, RTTY, SSTV, WeFAX, FAX, CW -- nearly any digital mode.

The MFJ-781 *DSP Multimode Data Filter™* gives you an arsenal of 100 incredibly sharp *No*Ring™* linear phase FIR filters.

Interfering signals are down by as much as 50 dB just 50 Hz outside passband!

You can choose 20 filters to include on the front panel for easy one-knob selection. Choose from . . .

. . . **64 data filters** with 16 Mark/Space pairs, 4 shifts, 4 baud rates

. . . **32 CW filters** with 8 CW tones (300-1000 Hz) and 4 bandwidths (50-500 Hz)

. . . **filters optimized** for these specialized modes: VHF Packet, Clover, WeFAX and SSTV.

Plugs between transceiver and multimode.

Input/output level controls. Easy-to-use input level indicator. Automatic gain control (AGC) keeps audio level constant during signal fade. ON /OFF/Bypass switch. Automatic self-test. Use 10-16 VDC or 110 VAC with MFJ-1312B, $12.95.

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MFJ . . . making quality affordable

Now we're ready to work on the coax feeder. The two hose clamps will be clamped to the pipes about 2-1/2" above the bottom crossbar. One will be screwed to the SO-239 flange and the other to the center connection, via the short piece of #16 wire. You'll probably have to drill a special hole to screw the SO-239 flange to the hose clamp. Now strip about 3/8" of the insulation from one end of the stranded #16 wire. Solder one end to the center hole of the SO-239 and the other to the clamp on the long vertical section of the antenna.

Tuning the antenna

Clamp the base plate to a stepladder or a railing away from close objects. Be sure your SWR bridge is capable of measuring at 450 MHz. Using low power, start by measuring SWR at the top, middle, and bottom of the band. The 2-1/2" feed point height above the crossbar should be very close. Move the feed point by sliding both clamps only 1/16" up or down. Try to find your best SWR on the repeater input part of the band, if that is where you plan to use the antenna. Using this design you should have an SWR below 1.5 over the band.

Parts List

Type M 1/2" copper tubing, cut to the following lengths:
    19" (1)
    12" (1)
    6" (1)
    1-3/4" (2)
13" of 3/16" copper tubing
1 1/2" copper elbow fitting
1 1/2" copper "T" fitting
2 1/2" copper end caps
1 1/2" copper threaded fitting
12" length of 1/2" birch dowel (for insulation)
1 SO-239 fitting
1 short piece of #16 stranded wire
2 5/16" x 7/8" stainless steel hose clamps
1 1/2" cast metal floor flange
Spray-on exterior clear finish
Plumber's tubing cutter
Electric drill and bits, 3/32" and 3/16"
Propane torch, solder and paste flux
Screwdriver
Electrical tape
Solvent and scrubbing pad (or steel wool or emery paper)
Caulking or silicone
1-1/8" x 2-1/4" sheet metal soldering shield
Drill press, small file (both optional)

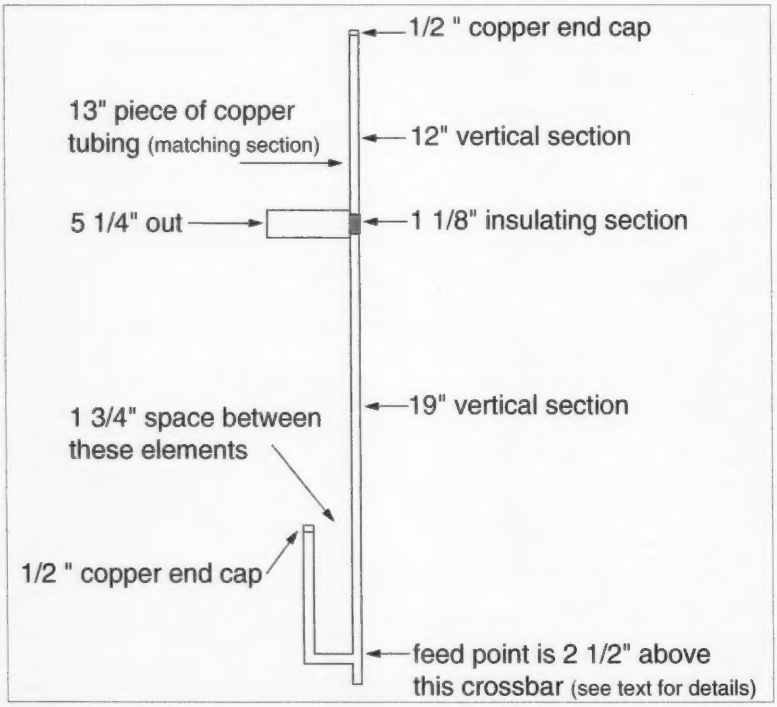

1/2 " copper end cap
13" piece of copper tubing (matching section)
12" vertical section
5 1/4" out
1 1/8" insulating section
1 3/4" space between these elements
19" vertical section
1/2 " copper end cap
feed point is 2 1/2" above this crossbar (see text for details)

Fig. 2. J-pole fittings detail.

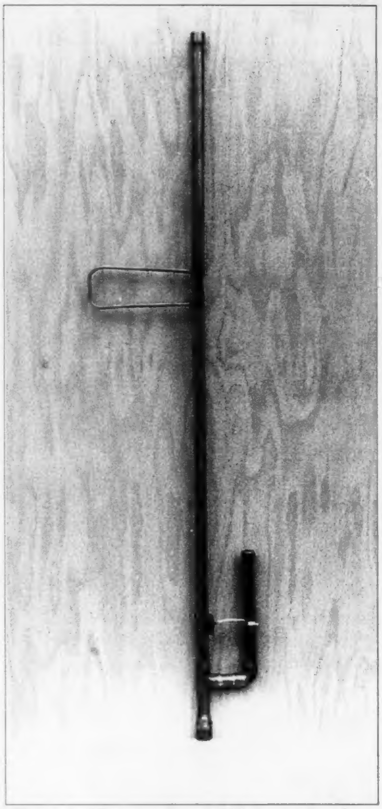


***Photo A.** The completed 440 Super J-pole.*

Tighten the feed point clamps, apply a coat of silicone to the back of the SO-239, and then spray a coat of exterior finish on the tuned feed point to seal out the weather. Tape the feed point connection to the coax, and also tape the feedline to your mast every two or three feet to make a neat, long-lasting, trouble-free installation.

Note

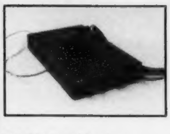
If you want even more gain you can add two more vertical half-wave sections, along with a horizontal matching section for each of them, using more birch dowel insulating sections. Place each matching section 120° from the section below it (otherwise you may distort the omnidirectional radiation pattern). This gave me three vertical half-wave sections above the typical J-pole design of a vertical half wave driven by the quarter-wave tuning section below it. Field strength tests showed that there was a 50% increase by adding the two vertical sections.

If you have any questions just send a #10 SASE to my home address above. ■

ORDER NOW 1-800 4 HOBBY KITS

- 2 Meters
- 223 MHz
- 440 MHz
- 6 Meters

FANTASTIC FM TRANSCEIVERS



Ramsey breaks the price barrier on FM rigs! The FX is ideal for shack, portable or mobile. The wide frequency coverage and programmable repeater splits makes the FX the perfect rig for Amateur, CAP or MARS applications. Packeteers really appreciate the dedicated packet port, "TRUE-FM" signal and almost instant T/R switching. High speed packet? ...No problem. Twelve diode programmed channels. 5W RF output, sensitive dual conversion receiver and proven EASY assembly. Why pay more for a used foreign rig when you can have one AMERICAN MADE (by you) for less. Comes complete less case and speaker mike. Order our matching case and knob set for that pro look.

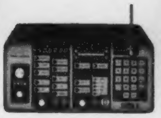
FX-50 kit (6 Meters)	$149.95	FX-146 kit (2 Meters)	$149.95
FX-223 kit (1 1/4 Meters)	$149.95	FX-440 kit (3/4 Meters)	$169.96
CFX matching case set	$29.95	FXM-1, ICOM/Yaesu style speaker mike	$29.95

QRP AMPLIFIER

For a slick little QRP boost, use one of the 20 Watt amplifiers. Needs only 1/2-2 watts of drive for full output, linear for SSB, AM or CW operation, power MOSFETs for high effieciency and multistage low pass filter for a clean signal. Built-in T/R relay for automatic switching, runs on 12-15 VDC at 2-4 amps. Add our matching case set for a complete station look.

Your choice of bands $49.95
Specify band: (QAMP-20, 30, 40, 80)
CQAMP Matching case set...... $14.95

2WAY RADIO SERVICE MONITOR



COM-3. the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantastic price—and our new lease program allows you to own a COM-3 for less than $3.00 a day. Features • Direct entry keyboard with programmable memory • Audio & transmitter frequency counter • LED bar graph frequency/error deviation display • 0.1-10.000 µV output levels • High receive sensitivity, less than 5 µV • 100 kHz to 999.9995 MHz • Continuous frequency coverage • Transmit protection, up to 100 watts • CTS tone encoder • 1 KHz and external modulation.

COM-3 2 Way Radio Service Monitor $2995.00

2 MTR & 220 BOOSTER AMPS

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz units. Both have all the features of the high-priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain) Fully wired & tested	$99.95
PA-20 220 MHz POWER BOOSTER (8 X power gain) Fully wired & tested	$99.95

FOXHUNT HEADQUARTERS

Locate hidden or unknown transmitters fast. The Foxhound direction finder connects to the antenna and speaker jack on any radio receiver, AM or FM from 1 MHz to 1 GHz. The antenna (a pair of dipole telescopic whips) is rotated until the Null meter shows a minimum. A pair of LEDs indicate to turn Left or Right. The Foxhound is ideal to use with a walkie-talkie. if you wish to transmit, go ahead, a built-in T/R switch senses any transmitted RF and switches itself out of circuit while you talk. It doesn't get any easier than this! We provide all parts except for a few feet of 1/2 inch PVC pipe avialable at any hardwar e store for a dollar or two. Add our matching case set for a complete finished unit. Be the one with the answers, win those transmitter hunts and track down those jammers, you'll do it all with your Foxhound.

Add some fun to your club events by having a transmitter hunt! Foxhunting is a craze sweeping the nation, but many clubs are missing out on the action because they lack the expertise or time to develop their own foxhunt transmitter. We set one of our most devious and sneaky engineers to the task of designing an easy to build and use, yet highly capable Foxhunt transmitter. A snazzy microprocessor controller has both preset and programmable transmission characteristics allowing you to easily set the difficulty level from "beginner" to "know-it-all"! The SlyFox, FHT-1, is crystal controlled in the 2 meter band (crystal for 146.52 included) with a power output of 5 watts that is adjustable by the controller.The transmitter is programmed to ID in CW or add our voice option if you really want to aggravate the troops - "Ha ha, you can't find me!" Join the fun, get rid of those stuffy old meetings and picnics. have a foxhunt!

DF-1 Foxhound direction finder kit	$59.95	CDF Matching case set for DF-1	$14.95
FHT-1 SlyFox Foxhunt transmitter kit	$129.95	FHID-1 Voice ID option	$29.95
CFHT Heavy duty metal matching case set for FH T-1	$29.95		

SX-20 20 METER SSB/CW TRANSCEIVER

Finally, a handy go anywhere rig that puts the fun back into ham radio. How about the DDS synthesizer that tunes in 10 Hz steps with exceptionally low noise for weak signal reception. Or, how about the built-in lambic CW keyer that has a digital readout of your CW speed. Perky 10 watt RF output (that's only 11/2S units below a 100 watt rig!) can be tuned down for true QRP operation. Included with the SX-20 is the hand mike with handy UP/DOWN buttons for remote tuning of the rig while driving — or biking — or boating. Available in both fully assembled and fun to build kit form, you'll find that the SX-20 will become your favorite rig.

SX-20 20 meter SSB/CW Transceiver, fully wired, 1 yr. warranty			$429.95
SX-20 20 meter SSB/CW Transceiver Kit Form			$349.95
Optional CW Audio Filter SXCWN WT	$49.95	Kit	$39.95

PACKET RADIO

Two new versions are available for the Commodore 64 (P-64A) or the IBM-PC (P-IBM). Easy assembly NO TUNING". Includes FREE disk software. PC Board and Full Documentation. Kit form.

P-64A	$59.95	P-IBM	$59.95	CASE CPK	$14.95

Miniature SPEAKER-MIKE

Fits Icom, Yaesu, Alinco, Ramsey and Radio Shack rigs! Looking for a handy little speaker-mike to compliment your FX transceiver or other ICOM style handie-talkie? The Ramsey SM-1 speaker-mike is a beauty. It's only 1 1/2" wide by 2 1/2 inches high and has a handy clip on the back so you can easily clip it to your lapel or shirt. Its small internal speaker isn't going to break any eardrums but is very clear and has plenty of pop to be heard when worn. There's even a jack on the mike so when you plug it in, you still have the use of the speaker jack from your radio. Fits all Radio Shack, ICOM, Yaesu, Alinco and Ramsey rigs.

SM-7 Mini-Speaker mike, Fully assembled	$24.95

CW KEYER

Send perfect CW. Microprocessor keyer features 4 programmable memories of up to 26 words each, lambic keying, dot-dash memory, variable speed from 3-60 WPM, adjustable sidetone, keying to any rig and fully RFI proof. EAROM memory keeps messages up to 100 years - you'll go silent before the key! Includes built-in touch paddles or use your own. Easy assembly and matching case set available for a nice station look.

CW-700 Micro keyer kit	$69.95	MK Matching case set	$14.95
CW-700WT Assembled CW-700and case			$119.95

ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!

AA-7Kit	$28.95	Matching case & knobset, CAA	$14.95

AIRCRAFT RECEIVER

Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit	$29.95
Matching case set, CAR	$14.95

STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

FM-10A Stereo transmitter kit	$34.95
CFM Case,whip ant set	$14.95

SPEECH SCRAMBLER

Descramble most scramble systems heard on your scanner radio or set up your own scambled communication system over the phone or radio. Latest 3rd generation IC is used for fantastic audio quality - equivalent to over 30 op-amps and mixers! Crystal controlled for crystal clear sound with a built-in 2 watt audio amp for direct radio hook-up. For scramble systems, each user has a unit for full duplex operation. Communicate in privacy with the SS-70. Add our case set for a fine professional finish.

SS-70 Scrambler /descramblerkit	$39.95
CSSD matching case set	$14.95
SS-70WT Assembled SS-70 and case set	$79.95

MICRO-MIKE

World's smallest FM wireless mike. Smaller than a sugur cube - including battery and mike. Two sets of SMT parts supplied in case you are clumsy! Terrific audio pick-up (pin drop at 5 ft) and transmit range of 300 ft. We include the battery (watch style), electret mike and even a tuning tool! Be a James Bond and learn SMT too!

FM-5 Micro mike kit	$19.95

CRYSTAL RADIO

Relive the radio past with a crystal set like your grandfather built. Uses genuine Galena crystal and catwhisker. Several different types of radios are built, including standard AM broadcast, shortwave and even WW II foxhole style. To compare modern semiconductor detectors, we include a diode for comparison. No soldering required and we even give antenna ideas. Radio for free, get it now before Clinton taxes it!

CS-1 Crystal set kit	$19.95

SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning. AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SR1	$29.95
Shortwave converter kit, SC1	$27.95
Matching case set for SR1, CSR	$14.95
Matching case set for SCI, CSC	$14.95

2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.

PA-1, 40W pwr amp kit	$34.95
TR-1, RF sensed T-R relay kit	$14.95

MINI KITS

Ramsey carries a complete line of low cost, easy to build, easy to use functional kits that can be used alone or as building blocks in larger more complex designs. Mini-kits include audio amps, tone decoders, VOX switches, timers, audio alarms, noise-makers and even shocking kits! Call for our free catalogue!

MORE KITS NEXT MONTH'S ISSUE

DR. NI-CAD CONDITIONER/FAST CHARGER

Quit spending big bucks for replacement battery packs, rejuvenate and condition your batteries for peak capacity. Advanced circuitry has optimized discharge before charge to eliminate memory effect and to condition batteries that have been poorly cared for in the past. Quick charge rapidly brings battery to full charge in less than an hour-just 15 minutes for some types! And "top-off" charge mode squeezes every last bit of energy into each cell for the absolute most capacity. Switch-mode regulator controls constant current charge while being monitored by a negative delta-V system that cuts off the fast charge at the exact point of full charge-batteries are charged, not cooked! Charges NiCads or NiMH packs from 2 to 10 cells (easily expanded) and current capacities up to 10 Amp-hours. Runs on 12 to 15 VDC. Quit cooking your batteries, buying new packs, waiting hours for recharge, get a Dr. Ni-Cad today! Available in money saving kit form or wired and tested with case at a special price. Kit builders: add our matching case set for a snazzy finish.

DN-1 Dr. Ni-Cad conditioner/fast charger kit	$49.95
CDN Matching case set	$14.95
DN-1WT Fully assembled Dr. Ni-Cad with case	$89.95

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The Hentenna

An easy construction project and a chance to experiment.

L. Scott Hall KA0DAQ
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Saint Cloud MN 56303
LScottH@aol.com

Don't you just hate it when antenna articles tell you how great the antenna is and then leave out some important piece of information? This happened with the hentenna. I've only seen two articles on it, one in QST (Feb. '82) and the other in Antenna-X (May '89). They both described its history and wonderful performance, but gave only the vaguest indication where the feed point should be. I had clipped both articles and filed them away, but it kept nagging at me. Well, I had to find out if it's as good as reported and where the feed should be connected.

The basic design of the hentenna is a simple wire loop. It's half a wave high and a sixth of a wave wide, making a tall, skinny-looking quad (total wire loop length is 1-1/3 waves, Fig.1), except it's not fed at the bottom or side, but from the inside. Exactly where on the inside? Near the bottom, but not too near.

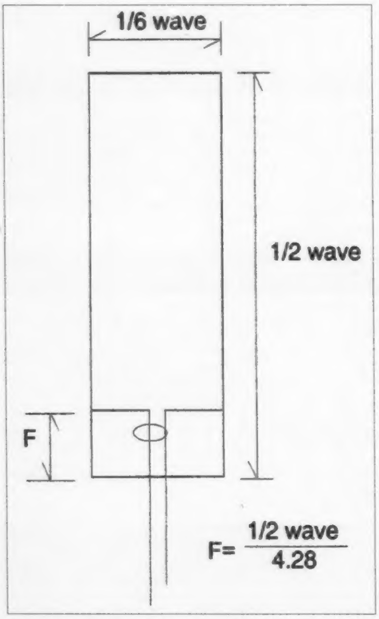

Fig. 1. The basic design of the hentenna is a simple wire loop. It's half a wave high and a sixth of a wave wide.

> ***"Construction is so easy there's no excuse for not having a hentenna around."***

Both articles made reference to a skeleton slot antenna to describe how this one works, but to me, it looked like a misshapen quad with a really fat tuning stub. The feed was placed one sixth of a wave up from the bottom, making the top loop, starting from the feed point, one wave long and the bottom loop two-thirds of a wave in length.

To start with I made a UHF model for TV. Using 14-gauge solid copper wire was easy; no supports were needed except the upright, a length of scrap wood (1" x 1"). My choice for a UHF TV station was one of the weaker ones. I didn't want to overpower the antenna and get poor readings. If it pulled in a weak station the lobes should be more pronounced (and they were). This UHF design performed better than I had hoped. Picture quality was equal to a flat four-bay commercial UHF antenna, but the hentenna had narrow lobes (bi-directional). I couldn't twist it much left or right before losing the signal. Tilting it forward or backward also lost the signal. It seemed directional with some gain, but without a boom. Could it work this well on 10 meters? I'd have a winner on my hands if it did.

Constructing the 10 meter hentenna was a little different. All three horizontal members had to be supported to hold up the 14-gauge wire. For the top crossbar I used a 1" x 2" five and a half feet long. For the other two only 1" x 1"s were used.

After soldering the loop together and attaching the top and bottom crosspieces, I measured out 67 1/2" up from the bottom to connect the feed. This starting point turned out to be too high. Measuring with the least possible power output the SWR was 3:1. Lowering the feed point one inch at a time was tedious. I went to three-inch steps, then two-inch steps, and finally one-inch steps. To make it a 1.1:1 SWR, I lowered the feed point 21 inches from where I'd started. I'd been way off. The final SWR curve was so flat I had to check it twice. At 28.0 MHz it had an SWR of 1.2:1, at 29.0 MHz it was 1.5:1, with the trough at 28.4 MHz and a 1:1 SWR, perfect for the Novice band.

Going back to the UHF test model and lowering the feed point to the right spot, I found the performance the same. If the UHF model worked the same, could it be hoped that the 10 meter prototype would be a wire wonder?

Wouldn't you know it? The band was dead. Sure, there are openings even during sunspot lows, but I couldn't find many after building the antenna. I did make some contacts; that says something for this antenna (gotta study those propagation predictions a little more closely). Sorry, not enough on-the-air reports for this one to make any solid conclusions. In general, this antenna is broadbanded with a low SWR. It's directive enough to eliminate some QRM if turned by some means.

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LETTERS

Continued from page 6

the newspaper and tell them the date and place of the next ham club meeting. Also, almost every high school has clubs. Find a teacher to sponsor a ham radio club, or get permission to talk to the computer or A/V club at the school. Be willing to spend time with prospective hams, and talk with their parents about the hobby. In recruiting new hams try to shake off the myths of ham radio such as the code obstacle and imagined expense. Point out the high technology of the hobby such as packet radio, SSTV, and circuit building. If just a few hams in every city decided to recruit one new ham in 1996, amateur radio would get the needed hobbyists and you would have a better chance of saving your precious frequencies.

One other suggestion. Public and high school libraries suffer from a dearth of current books on technology, electronics, ham radio, etc. While looking for info on hamming, if I could find books, they'd be twenty to thirty years old. It's hard for me to believe the ARRL wouldn't have some sort of deal where a club could buy certain books for local libraries. *(Ben, when I got interested in amateur radio I first turned to my school library, where I found* QST *and* Radio. *In looking over the 73 subscription records I see very few school libraries subscribing. You or your club could help attract the youngsters we so desperately need by providing gift subscriptions to 73 for your local school and town libraries. Wayne)*

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CIRCLE 186 ON READER SERVICE CARD

Sacrificing another wire for another band, I grabbed the handie-talkie and headed for the calculator; I'd make a 2 meter version with the ratios from the 10 meter hentenna.

I was sick of converting decimals to English measurements, so metric was the rule of the day (and it was a lot easier). Rewriting the little program to come out in meters was easy; it was just replacing one formula. After doing the calculations and construction in metric it'll be tough to go back to English measurements. I wonder if the local hardware super-store has a 20 meter tape measure? (Ha!)

Construction of the 2 meter hentenna is similar to the UHF model, however, the 2 meter model needed a top crosspiece to support the weight of the wire. Staples held the crosspiece to the upright and the coax to the mast. I don't have a VHF SWR meter, but Hank Koch NF0H does and that weekend he was working on the local repeater. Hank was happy to help out and we charted a few SWR points.

Setting the handie-talkie to 146.000 MHz we read the SWR as 1.3:1. "Hey, you could use it just like that," Hank said. "Let's try down the band." Next at 145.000 MHz it was 1.2:1 and then 1.4:1 at 147.000 MHz. Is that broadbanded enough for you?

> ***"The hentenna is a great VHF project to add a little gain for portable operations or a simple base antenna for simplex or repeater work as well as the 10 meter Novice band."***

I thanked Hank for his help and went home to play twist and chart. The UHF-TV model had such sharp lobes I thought I'd chart the radiation pattern of the 2 meter hentenna. By finding a signal source and then twisting the antenna until the signal strength meter read down three dB (the half power point, Fig. 2) I could chart (roughly) the radiation pattern. The strongest signals were received when the hentenna was held straight up and the face of the antenna held at a 90° angle from the signal source. Tilting the hentenna forward, and then back, gave an estimate of the forward radiation angle. It came out uneven; 35° forward or 40° back brought the signal strength meter to the half power point. Twisting right and left brought more off center readings, 80° one way and 40° the other, the difference being which side the shield is connected to. The largest null is on the side the shield is connected to, 100° from half power point to half power point. On the center conductor side, the null is 20° wide. All this would even out, I guess, with the use of a balun or balanced feed as described in both reference articles (they both used a bazooka feed). I didn't use any matching feed system in my experiments so I could find the 50-ohm feed point without added hardware, and it makes construction easy.

Performance

Performance on the air is surprising. Most radiation is horizontal when held upright, with some vertical polarization, a combination that makes for a good general-purpose antenna. Some gain is evident, as much as a three element yagi maybe. Repeater reception is better when the hentenna is tipped sideways, but not too much.

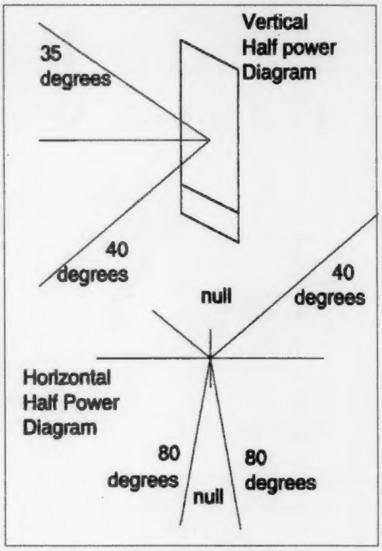

Fig. 2. Hentenna radiation pattern.

Tipping the hentenna sideways gave me an idea. If I made a 15 meter hentenna it would fit (tipped horizontally) in the attic. Well, I made it right there in the attic and the SWR was way too high. Thinking that it was the stray capacitance from roofing nails and assorted metal valleys I moved the antenna outside and hung it from the eaves. It hung down to within two feet of the ground and two feet away from the house. Same lousy SWR. What with yard work and winter coming this one would have to wait for another season.

The hentenna is a great VHF project to add a little gain for portable operations or a simple base antenna for simplex or repeater work as well as the 10 meter Novice band. Construction is so easy there's no excuse for not having one around.

These are all wire, temporary antennas for experimenting. For outdoor, permanent antennas you'll have to use more durable materials. I had to leave something for you to figure out for yourself, didn't I?

Hentenna measurements

Band	1/2 wave	1/6 wave	Feed point
10m	16' 6"	5' 6"	3' 10-1/4"
6m	8' 10"	2' 11-1/4"	2' 1/16"
2m	3' 3"	1' 1"	9' 1/8"

Table 1. Hentenna measurements for 2, 6 and 10 meters.

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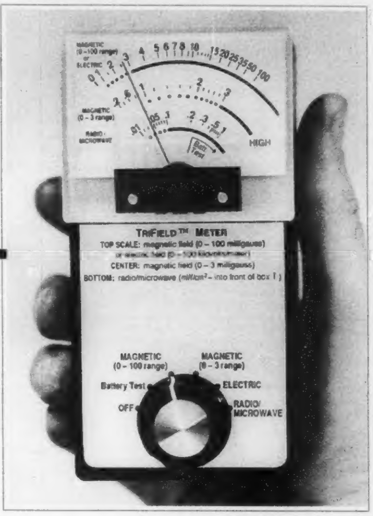
73 Review

The TriField Meter

Do you trust your *microwave oven?*

Michael Jay Geier KB1UM
c/o *73* Magazine
70 Route 202 North
Peterborough NH 03458



This has to be one of the most unusual products I've ever reviewed. The TriField meter is intended to measure magnetic, electric and radio (electromagnetic) fields, in order to help you avoid unnecessary exposure to these controversial emissions. The unit employs separate sensors for magnetic and electric fields, and it comes with a treatise that discusses the probable effects of the various kinds of fields and how the human body responds to them.

The meter itself has three calibrated scales. One reads magnetic fields in the 0 to 100 milligauss range, and also reads electric fields when the unit is set to detect them. The second scale reads much smaller magnetic fields, in the 0 to 3 milligauss range, while the last one reads radio and microwave emissions in the range of 0.1 to 1 milliwatt per square centimeter.

> ***"It's reassuring to know I'm not getting cooked along with my dinner!"***

The magnetic and electric field settings are frequency-weighted from 30 to 500 Hz and are calibrated at 60 Hz. The readings increase with frequency. So, a 2-milligauss field at 60 Hz will read "2" on the meter, but a 2-milligauss field at 120 Hz will read "4." This is intentional, because, according to the instructions, the currents induced in the body are proportional to field strength multiplied by frequency. Essentially, that makes the meter an indicator of induced body currents, rather than a field strength measurement device.

The choice of 60 Hz as the reference point was made, of course, because it's our powerline frequency. The unit's sensitivity increases linearly with frequency until about 500 Hz, and then it stays roughly level (± 20%) up to 1 kHz. After that, it gradually reduces to zero at about 100 kHz, although there is some residual sensitivity up to about 100 MHz. Overall accuracy is specified at ± 20% for magnetic fields, and ± 30% for electric fields, RMS at 60 Hz.

Using it

The meter is housed in a plain plastic box, and is powered by a 9-volt battery, which is supposed to last about 30 hours. Changing the battery requires unscrewing the back of the box.

A rotary knob lets you select the five ranges and a battery test range, which is a handy feature. Although the internal positions of the various sensors are described in the instructions, there's no mention of them on the unit itself. The electric field sensor is at the top of the unit, and the three magnetic sensors are on the front, below the meter. Operation is as simple as selecting the kind of field you want to see and moving the meter around near the field's generator.

The results can be surprising. My laptop shows significant magnetic fields around the hard drive and the power supply for the backlight, as I would expect. It also shows noticeable electric fields in front of the display, no doubt from the backlight element itself. No measurable radio fields are detected, probably because they're at too high a frequency for the TriField meter to have much sensitivity to them.

My desktop computer monitor shows strong magnetic fields near the face of the CRT, but they fade away rapidly. While electromagnetic near fields become weaker in accordance with the inverse square law (the strength of the field is inversely proportional to the square of the distance), magnetic near fields follow the inverse cube law (they're inversely proportional to the cube of the distance), making them become much weaker for a given distance.

Using the radio setting around the seal of my microwave oven door shows a very low leakage rate; I guess my oven's in good condition. It's reassuring to know I'm not getting cooked along with my dinner!

Is it for you?

This device isn't meant as an antenna field strength meter! Its non-linear interpretation is clearly geared toward telling you what the received fields might be doing to your body, based on induced currents. If you don't know the frequency of the received fields, there's no way to determine whether the actual field strength is, say, 9 milligauss at 60 Hz or 2 milligauss at 250 Hz. So, for normal, home use, the meter is best used as a relative-strength guide to sources of significant emissions, rather than as a method of obtaining actual field strength measurements.

The included paper is well-written and fairly detailed, but it is important to note that no conclusive evidence of harmful effects of low-level fields exists. In fact, the literature goes so far as to state "some readings in the high (red) zone may ultimately prove not to pose a health risk." In

Continued on page 19

The Big Loopy Skywire

Cheap and simple, with a bodacious signal.

Dean Frazier NH6XK
94-567 Kuaie St.
Mililani Town HI 96789

When the Loop Skywire is mentioned, most amateurs immediately think of acres of property with no antenna height restrictions. But such conclusions are misconceptions when it comes to putting up a Big Loopy, and generating the "Big Signal." For the Big Loopy, a full-wave loop in the horizontal plane, the area needed, and the best height, are all pretty much dictated by the frequency of the *lowest* amateur band on which operation is desired.

Loop size depends on frequency

For 80 meters, you need 1005/3.75 MHz = 268 feet of wire which would be 268/4 = 67 feet on a side if the antenna is square; but a Big Loopy on 10 meters would require 1005/28.4 MHz = 35.4 feet of wire. That is, 8.85 feet on a square side, and it might as well be hung vertically as a true quad loop. However, there is a point where a vertical loop becomes impractically large to erect: a vertical loop for 40 meters would be 1005/7.15/4 = 35 feet per side, out of the question for most amateurs. But since the radiation from a full-wave loop is not all perpendicular to the plane of the loop, a large loop strung horizontally does work.

My experience, and that of others who have put up a full-wave loop for 80 meters, is that the loop radiation goes up at high angles, which is great for propagation out to about 1,100 miles and multiples of this distance. Upon reflections, the signal comes down "hard." The very first night I tried the Big Loopy, I managed to communicate with the radio operator on an oil tanker in the Caribbean (5,500 miles distant from my QTH in Hawaii) on 80 meters. Although I was running 400 watts I was told that my signal was obnoxiously loud.

The Big Loopy

My Big Loopy measures 285 feet around, and it is not at all round or square, but as seen from above, has the outline of a necktie (see Fig. 1).

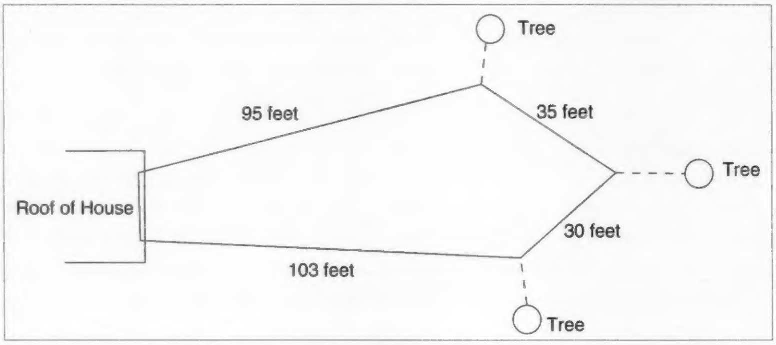


Fig. 1. Layout details of the Big Loopy.

Although the *Handbooks* recommend 272 feet for the loop on 80–10 meters, I chose this length of wire based on the following calculations:

1005/285 = 3.526 MHz

and multiples of this frequency are

7.053, 10.579, 14.105, 17.632, 21.158, 24.684, and 28.211 MHz

which multiples more or less match my preferred regions of operation on the HF bands. Had a 272-foot length been chosen, all frequencies for lowest SWR given above (for a length of 285 feet) would be shifted higher by a factor of

285/272 = 1.048

e.g., 7.053 MHz would have been 7.39 MHz, *out of band*. Also, the bands for which 285 feet of wire will not quite be on resonance (for which there would be some reactance), are handled by a simple Inductance/Capacitance (L/C) tuner, or "Matchbox," at the shack.

The Big Loopy is fed with 52 ohm coax, as the feed point impedance is between 50 and 100 ohms. Air RF choke baluns are used at both the feed point end and at the shack, to help suppress any RF currents induced on the outer braid of the coax (unbalanced feed line) from the loop radiation. A 1:1 balun at the feed point could be used. And an open ladder-line feed system would probably be best, but up to 700 watts, on all bands through 80 meters, I have not experienced RF.

The feed point is 30 feet up, at the rear end of the house, 70 feet from the shack. The elongated, but not quite folded, dipole outline of the Big Loopy is 40 feet off the ground at its highest point, and the low point is 25 feet high. The long axis orientation is east-west.

As Fig. 1 shows, one end of the wire of the Loopy is connected to the coax center conductor, while the other end returns to the feed point braid. The corners are attached to their respective tie-down points with nylon line. The wire is #12 A.W.G PVC covered solid copper. Note that the east end of Big Loopy is triangular, sloping down, and buried in the forest behind the fence of the property line.

Theoretical considerations suggest that nowhere in the loop should the wire double back on itself; you should try to keep all corners or "turning points" less than or equal to 90° so you don't suffer from signal cancellation. For the strongest signal, you want to make the loop as "open" (covering as much area) as possible. The facts that the loop is neither circular nor square, and is not very high, all result in some increased angle of radiation and reduction in signal strength, but these effects are not as bad as one might guess. The ideal loop would, of course, be circular. With 285 feet taken as the circumference of a circle, this would result in a $285/\pi$ = 90.72 foot diameter circle of 45.35-foot radius, which gives an area of $(45.35)^2$ x π = 6464 square feet. A square loop in comparison would have sides 285/4 = 71.25 feet, or an area of $(71.25)^2$ = 5077 square feet. The ratio of areas is a measure of radiated signal strength: 5077/6464 = 0.785; dB = 10 log (0.785 = -1 dB. The square loop would be "down" in signal strength from that of a circle's by about 1 dB. As configured, my Big Loopy suffers about 1.5 dB compared to the radiation from a circular loop of the same length wire. However, when you consider that a full-wave loop shows 2 to 3 dB gain over a dipole, at least on 80 meters, I'm still ahead. And on 40 meters, where a full wave 80 meter loop is 2 waves, the Big Loopy has 2x3 = 6 - 1.5 = +4.5 dBd, calculated on the conservative side, or 3x3 = 9 - 1.5 = +7.5 dBd if one is optimistic. Necessarily, doubling the wire, e.g., doubling the number of full waves on the wire at a given frequency, adds about 3 dB of signal strength. On 20 meters, where the Big Loopy is four full waves, then at worst, the gain is 4x3 = 12 - 1.5 = +10.5 dBd. No wonder I am told by hams on the mainland that the Big Loopy produces the "Bodacious Signal."

Furthermore, the Big Loopy is hard to beat when used on 40 and 80 meters, inter-island. I run 10-20 watts, and usually am 59 or "in the red" on the outer islands (Kauai, Maui, Hawaii).

So if you are fortunate enough to have a bit of area, put up a Big Loopy, even if you can only manage 71 feet of wire or so, about 17 to 18 feet on a side, for 20 meters. This will give you 2 waves on 10 meters, and 1-1/2 on 15 meters; the 12 and 17 meter bands being tunable via an ATU or matchbox. Don't worry if your antenna is not exactly square or level or very high. Just put one up and give it a try. You'll put out *some* signal which will go *somewhere*, and you might be pleasantly surprised. And then you can enjoy the fun of tilting a side or an end of Big Loopy to put a lobe where you want. Or you might try loading two sides with about 360 ohms of inductive reactance to create a "Big Baby Loopy" to achieve more gain in a desired direction (see *73 Amateur Radio Today*, November 1992; "Baby Loopy").

The TriField Meter

Continued from page 17

other words, you are free to interpret and worry as you please.

It is important to note that the magnetic field sensors capture only AC fields—you can't use this thing to see how far your speaker magnet's field extends. It is possible to measure steady-state magnetic fields, but it requires a more sophisticated type of measurement device called a magnetometer, which the TriField meter does not contain. As health studies do not currently indict steady-state fields, Alphalab apparently saw no reason to increase the unit's cost to make it possible to measure them.

If you're worried about what your gadgets' fields might be doing to you, the TriField meter will help you find the best placement for your devices and yourself, so that you can minimize your exposure. The price is very reasonable for what it does. It's an interesting and unique product. It's available from Alphalab, Inc., 1280 South Third West, Salt Lake City UT 84101. For additional information contact David at 503-543-6545.

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CIRCLE 194 ON READER SERVICE CARD

Easy to Build 10m Beam

The Sun-spots are coming. The Sun-spots are coming.

Adam J. Felde N6CJU
1627 E. Ave. Q-12
Palmdale CA 93550

This antenna uses four half-wave dipoles whose elements are all cut to the same length. The dipoles are mounted on the boom in piggyback fashion, one above the other. The four dipoles are numbered for identification:

Dipole #1 is at the front of the boom.

Dipole #2 is at the rear.

Dipole #3 is above dipole #1.

Dipole #4 is above dipole #2.

The dipole elements are in a horizontal plane with the earth. This element arrangement allows the use of a quarter-wavelength boom, and makes it possible to use a quarter-wavelength of air space time—the distance between the two sets of dipoles—on an alternate time share basis.

The design frequency is 28.700 MHz. Dipoles #1 and #2 are a set, and dipoles #3 and #4 are a set. Half-inch tubing is used for the dipole elements, which are insulated from each other and the boom. The two sets of dipoles are separated from each other (electrically) by a quarter-wavelength of RG-8U coax delay line. This causes the dipole sets to follow each other by a 90° delay. For example, dipoles #1 and #3 fire in sequence, and dipoles #2 and #4 immediately follow, also in sequence, making one complete cycle of all four dipoles. The close spacing between the elements has no ill effect on performance. Assuming the initiating signal from the transmitter to be a positive-going waveform, dipole #1 will be the first to radiate, followed by #3, whose signal phase has gone negative, along with #2, both of which are 180° for that instant. And, since dipole #3 is at the same place on the boom as dipole #1, dipole #2 will lag dipole #3 by 90° (the distance between dipoles #3 and #2). This will cause a cardioid (heart-shaped) waveform to be radiated from dipoles #1 and #2. In other words, dipoles #1 and #4 radiate a positive-going wave, and dipoles #3 and #2 radiate a negative-going wave. See Fig. 1.

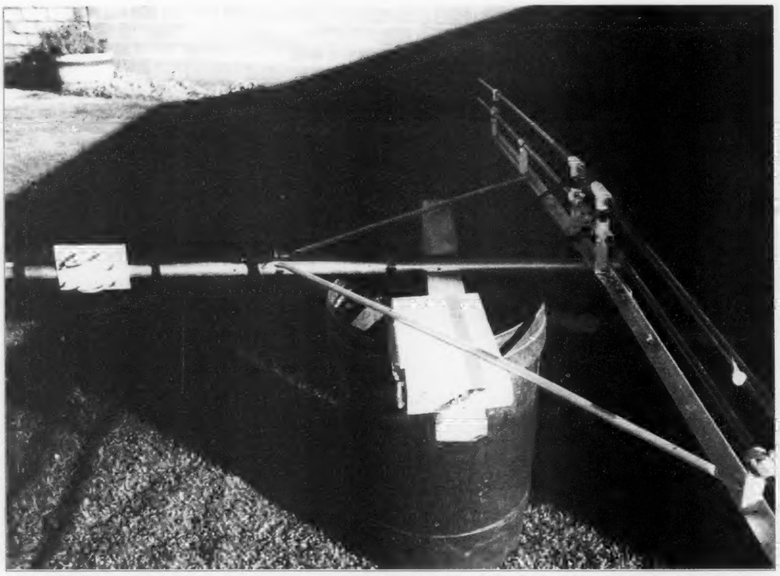

Photo B. *To drill the bolt holes for mounting, flatten 1" of the ends of your 1/2" tubing, creating a support angle stabilizing wishbone.*

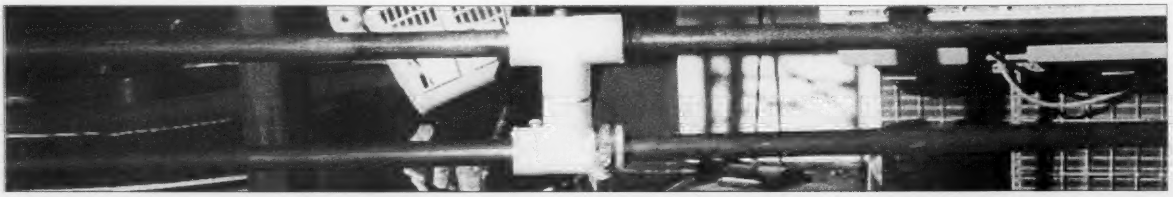

Photo A. *The elements are supported by the PVC plastic three-way "T" of lawn sprinkler pipe to make an "H."*

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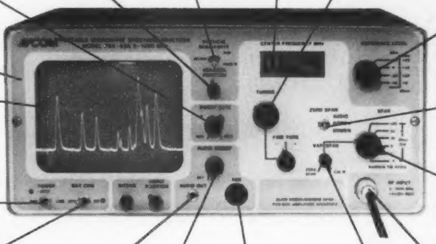

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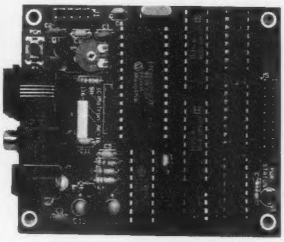

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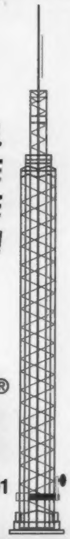

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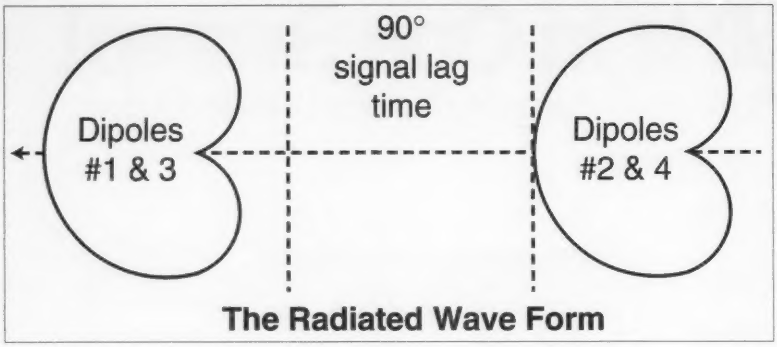

Fig. 1. The cardioid waveform.

The SO-239

Drill, in the exact center, a 5/8" hole in a 3/16" thick 3" x 2" piece of Plexiglas™. Drill another hole, capable of receiving a #6 bolt and nut, 1/2" from each end, in the center, to fasten the assembly to the dipole elements. Place an SO-239 chassis adapter/connector plate into the 5/8" hole, and drill four #6 screw holes through the existing holes in the connector body to bolt the SO-239 into the Plexiglas piece. Solder "pigtails" to the connector's center conductor, and to the conductor's outer body, for connection to the dipole elements. Make four of these assemblies, one for each of the dipoles.

Mounting the Dipoles

The dipole elements are mounted on 10-foot aluminum 2" x 2" x 3/16" angles (the elements are insulated from the angles). The boom will be nine feet long. The aluminum dipole support angles will have a "V" stabilizer, reaching from some point on the boom, with the open end of the "V" legs bolted to the aluminum angle spread open to reach at least a two-foot spread on each side of the boom, to make the antenna wiggle-proof (and bird-proof).

The Driven Element

Use a schedule 40 white plastic lawn sprinkler fitting, and a three-way "T" for 1/2" plastic schedule 125. You cut a 2" long piece of the schedule 125 pipe to cement into the leg of the "T," then take another "T" and cement the two units together, fashioning an "H." On the boom the "H" will lie sideways. See Fig. 2.

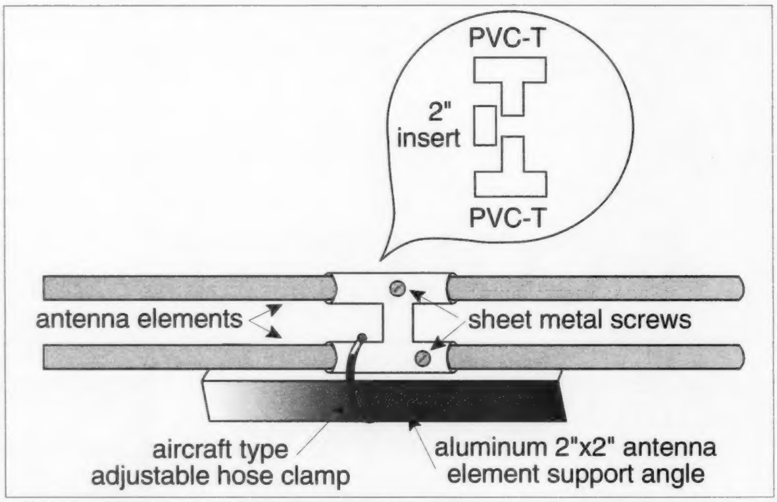

Fig. 2. A pictorial view of the driven element insulator/supports.

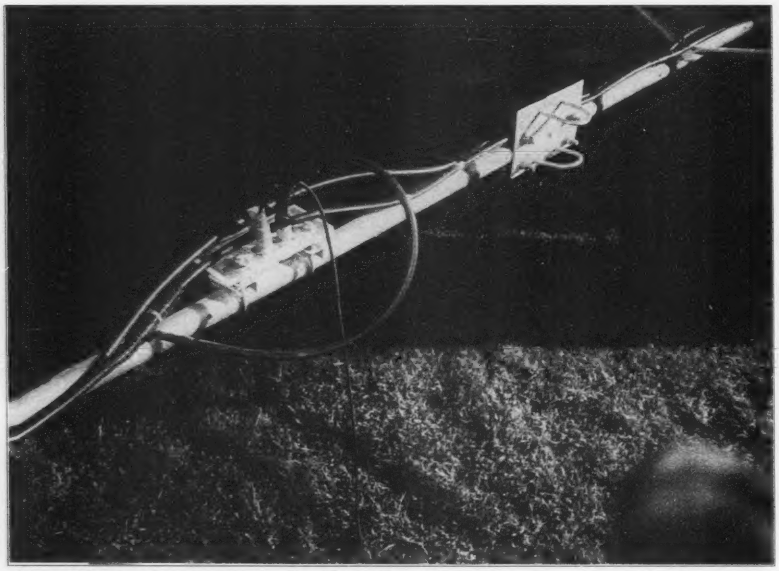

Photo C. *Note the mounting for the delay line and feedline connectors; it's made of 3/16" Plexiglas™ wide enough to receive exhaust pipe-type "U" clamps bolting the unit to the boom.*

Use an aluminum 2" x 2" x 6' (10-foot is better if you can find it) angle. The insulator/supports you are going to make are clamped to the aluminum angle using #16 adjustable hose clamps. Position the element supports on the aluminum angle so the legs of the "H" are horizontal with the aluminum angle. Clamp them to the aluminum angles shown in Photo D. Slide the dipole elements into the supports and place them so the ends of both halves of the dipole are equidistant from the boom. Drive a sheet metal screw through the plastic support and into the dipole element, being careful not to come in contact with a clamp

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and accidentally ground an element. Do this in two places on each dipole element.

The Coax Hookup Assembly

For dipoles #3 and #4, connect one end of a 10' 11" coax into the SO-239 chassis mount on dipole number 4, and connect the other end into the coax "T" (M-358). Connect a 5' 5-1/2" length of coax into the opposite end of the "T," and terminate the coax into the SO-239 chassis mount on dipole #3. Put a PL-258 coupler into the center terminal of the coax "T," and connect another 5' 5-1/2" length of coax to the end of the PL-258 connector. See Fig. 3.

For dipoles #1 and #2, connect one end of the last 10' 11" of coax into the SO-239 chassis mount on dipole #2, and connect the other end into the coax "T" (M-358). Then place a double PL-259 into the coax "T" and connect another coax "T" to it. Then, using a PL-258 connector, connect the center terminal of the second "T" with the

Continued on page 35

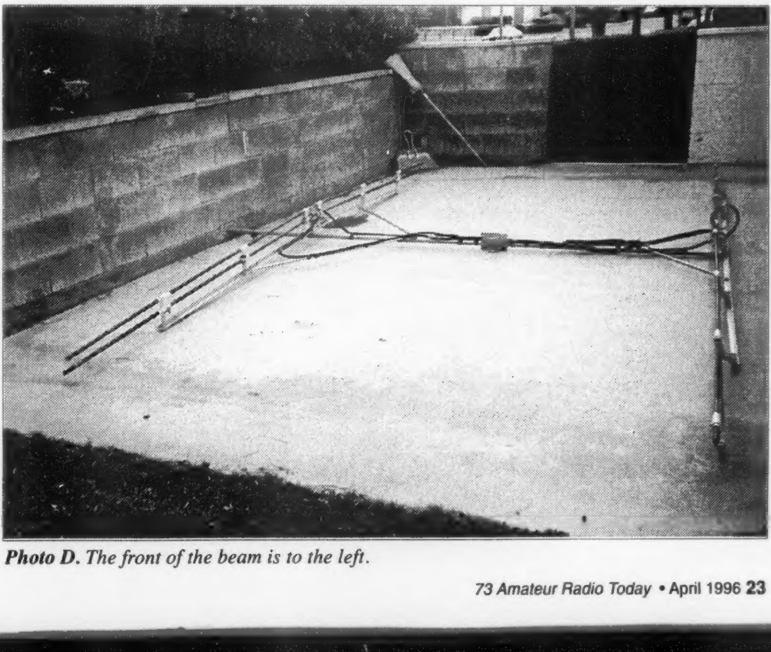

***Photo D.** The front of the beam is to the left.*

CB 148/450 Dual-Band Corner Reflector

Big dual band signals are just around the corner.

Larry Antonuk WB9RRT
Box 452
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After years and years of doing product reviews, you tend to get fairly immune to boastful claims from various manufacturers. Of course people tend to exaggerate when they're talking about their own products—this is expected, and you learn to filter out the facts from the hyperbole. Still, some products come along described in such glowing terms by their makers that it's hard to keep an open mind when reviewing the product. As an example, I received the product literature for the Arrow Antenna 146/435 Corner Beam antenna well before I got the actual antenna. Glancing over the spec sheets, I found quite a few phrases that got my attention. Consider the Arrow Antenna motto: "Simply the Best." Or maybe the description of the Corner Beam: "This is an impressive antenna, no matter how you look at it." Or even the relatively humble "Arrow Antennas manufactures a very select line of products." Well, I thought, there's no shortage of hubris in Loveland, Colorado.

A few days later, as soon as I slid the antenna out of the package I had a thought: "You know, these guys might be telling the truth!"

What's a corner beam?

Before going into details, it might be a good idea to review the reasoning behind getting a corner reflector in the first place. In the overall scheme of things, corner reflectors have a spot in the logical progression of antenna evolution. The ordinary dipole gave way to the Yagi-Uda, which utilized directors and a reflector. The single reflector was turned into a screen for a greater back-side rejection. The screen was then formed into a right angle (or a 60° or a 45° angle) to improve the front-to-back ratio, which created the corner reflector. If the reflector is rotated in a full circle around the single driven element you get a parabolic dish antenna. Building a parabolic dish at VHF frequencies can be a tricky maneuver. Due to wavelength dimensions, however, a high gain 2 m or 70 cm antenna is most effectively built using corner reflector methods.

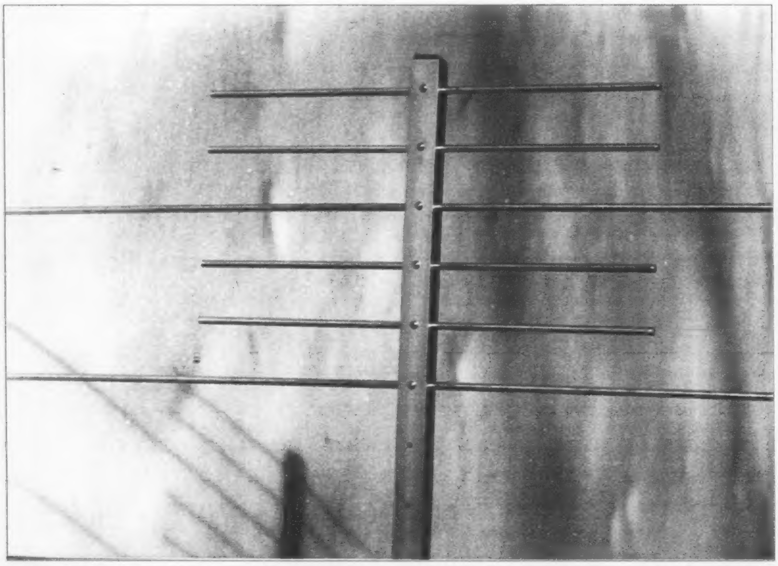

Photo 1. *The best of both worlds, the Corner Beam staggers UHF reflectors with longer VHF reflectors.*

So what does a corner reflector have that a plain old Yagi-Uda doesn't? First, it's much shorter. A standard beam antenna with the same 10 dB gain as the Corner Beam would have to be 10 feet long. The Corner Beam's longest element is four feet long, making it ideal for mounting and rotating in a smaller space. Second, the directivity is the same or better than a Yagi-Uda with the same gain. Third, the 40 dB front-to-back ratio makes it ideal for nulling out interference from other stations, or for concentrating all of the signal from a transmitter toward a given geographic area. And fourth, a corner reflector has a much wider bandwidth than a beam. As an example, a typical standard beam will have a 2 to 4 MHz bandwidth with an SWR of less than 2:1. The Corner Beam lets you operate across the entire ham band with an SWR of less than 1.2:1—virtually flat. In addition to all of these benefits, the folks at Arrow Antenna

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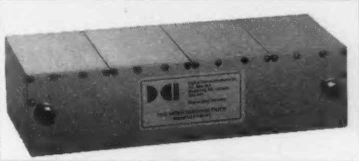
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Continued from page 4

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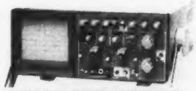
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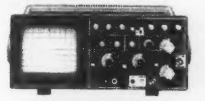
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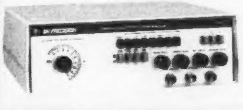
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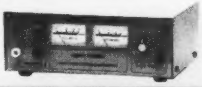

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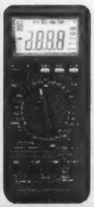
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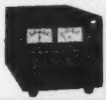
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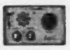
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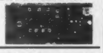

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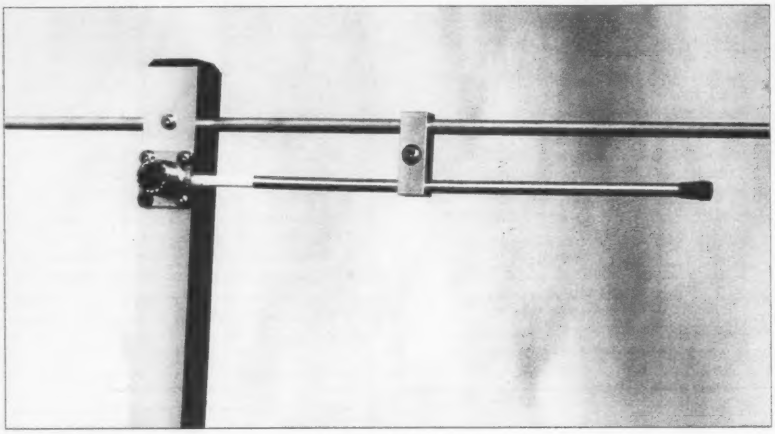

***Photo 2.** Quality construction is evident in this closeup of the VHF driven element and gamma match.*

have created a dual-band version of the corner reflector. The 146/435 consists of two separate corner reflectors sharing the same boom structure. The shorter UHF elements are interspersed with the longer VHF elements, and both driven elements share the center boom. Because of the vast difference in frequency the elements for each band are "invisible" to the elements in the other frequency band, meaning that you can have two high gain, highly directional antennas in the space needed for one VHF corner reflector. You can use them both at the same time if you have separate radios, or use them with a duplexer and a single run of coax with your dual band transceiver.

An impressive antenna?

Once you've decided that a corner reflector is just the thing for your repeater or packet link, is the Arrow Corner Beam the way to go? Is it really "an impressive antenna, no matter how you look at it."? Yes. The quality that goes into the Arrow Antenna products is obvious, from the second you open the package. It comes completely broken down in a 4" x 4" x 4' box. Each of the booms is wrapped in plastic to avoid scratches during shipping, and these are wrapped together with foam packing. Hardware is carefully packaged, and the elements are stored in the boom tubing. The three booms are made of 1" square T-6061 aluminum tubing, a high grade material used in many industrial applications. The reflectors and driven elements are made from quarter-inch solid aluminum rod—not tubing. The gamma match on the driven element consists of a carefully machined shorting bar, along with a plastic insulator for the rod that comes up from the SO-239 (VHF) or N (UHF) connector. Even the design of the gamma match is well thought out—the shorting bar and match are aligned in the plane of the main boom, meaning that the pattern of the antenna will be truly symmetrical. The hardware is all stainless. The documentation is not extensive, but very clear.

Anyone should be able to assemble this antenna in under an hour, using just a Phillips-head screwdriver and a couple of adjustable wrenches. As I assembled the antenna, the quality of the product became more and more evident. All the holes were precisely drilled and completely deburred—all the reflectors slid smoothly through the booms, and all the mounting screws then threaded easily into each reflector. There was no missing hardware, and the gamma matches went together and tuned up easily.

The main boom allows for easy mounting to a tower leg or mast section, in either a vertical or horizontal orientation. (Of course, you can't split the polarity between bands—both driven elements are on the same boom, and both will always be the same polarity.)

But does it work?

Regardless of how well made an antenna is, the proof of the product is in the operating. I already had a three element dual-band Yagi mounted on my rotatable mast. I mounted the 146/435 right below this antenna and borrowed one coax run from the Yagi, running both antennas on 450 MHz. This allowed me to use the switch box to run A/B comparisons. Obviously, the comparison was not totally fair—the Corner Beam has quite a forward gain advantage over the Yagi. Still, the results showed how big a difference a few dB can make. Signals that were barely readable on the Yagi came in loud and clear on the Corner Beam. Signals that were just barely workable on the Corner Beam were simply not to be found using the Yagi.

What can I do with it?

What are some of the applications for an antenna of this type? The fact that the 146/435 is actually two antennas in one, and no more than four feet on its longest side, means that it's a very space-efficient antenna that still gives you the gain of the big beams. If you have a small amount of antenna space the Corner Beam might be just the ticket—mounted on a rotating mast, on a tower leg, to the side of your house, or even tucked in the attic. The great front-to-back ratio of this antenna makes it useful for a lot more than simple home station applications, however. You might have a repeater that needs to cover a fixed area. Perhaps the only hill in your area is way north of town, and you have no interest in covering anything to the north of the hill. Why not concentrate all your power back toward town, instead of spreading signal where it isn't needed? Most repeater groups probably have another repeater on your frequency in the next state that gives you trouble now and again. Why not use the Corner Beam (or two) to null out the interference from the other site? More esoteric applications abound. Corner Beams would make excellent antennas for use with passive repeaters—two back-to-back antennas, used to dribble some signal into areas otherwise unreachable by the main repeater. Any fixed data or packet application would be well served by a corner reflector. How about a VHF/UHF crossband repeater, using only one antenna? Foxhunters will have fun with this antenna as well. Put the fox in a hard to reach spot, and point the Corner Beam at an easy to reach hill. With very little signal coming off the back of the beam, and lots of signal coming off the hill, all but the craftiest hunters will be kept busy for hours.

Drawbacks

Actually, I could find nothing negative with this antenna. However, one point to consider before you purchase any corner reflector concerns the wind load of the antenna. The wind load of the 146/435 is specified at less than three square feet, which puts it in a league with a 20 element 2 m beam. This in itself is not a problem, but bear in mind that the wind load (and the weight of the antenna) is asymmetrical—all of the wind and weight load hangs off one side of the mast, greatly increasing the amount of torque that can be applied to the mast and rotator. This means that while you can probably get by with an inexpensive TV rotor to turn this antenna, you might run into problems during high winds or icing conditions. The best approach would be to use a heavy duty rotator, or to mount the Corner Beam on your main mast under your HF beam.

Is it "simply the best?"

Is it the best in the whole world? No. If you have a bottomless checkbook you can find some commercial antennas that are even more rugged than the Arrow Corner Beam—at about ten times the price ($165). Is it the best in the amateur market? I think it is. Is it the best bet for gain and quality per unit price? Absolutely. Regardless of your application, you'll be hard pressed to find a better way to spend your antenna dollars. The Arrow Corner Beam uses construction techniques that rival or exceed many commercial antennas, at an affordable amateur price. It's a pleasure to see that a company has taken a stand with quality materials and excellent craftsmanship, and that stands behind its products with a ninety 90 day, no hassle refund policy. In addition to the 146/435 dual band antenna, the Corner Beam is also available in single band versions in 148, 220, and 450 MHz models. Any of these antennas may be obtained through Arrow Antennas and are nationally distributed through Antennas West, Box 50062, Provo UT 84605 (800) 926-7373. 73

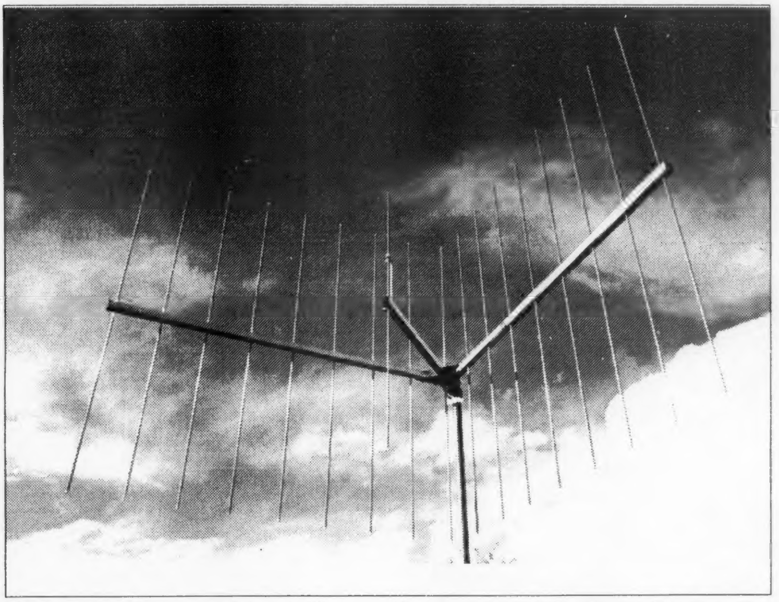

Photo 3. *Only work one frequency? A monoband version of the Corner Beam is also available from Arrow.*

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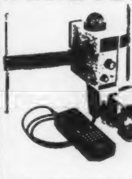

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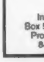

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John Sehring WB2EQG
P.O. Box 373
Baker MT 59313

A recent article in *QST* which evaluated a number of different antenna-matching devices caught my attention. The venerable Johnson Matchbox got high marks for efficiency and degree of balance. It was proven to compensate for a fair amount of reactance from an antenna operated off-resonance.

I had always wanted a Matchbox in order to feed my large balanced-fed loop antenna with 50 ohm coax on all bands, but I'd never found a Matchbox at ham radio flea markets for the right price. I built a copy of one instead. It was an uncertain affair because I had only a small photo of the innards of a Matchbox to guide me. Matchboxes are somewhat hard to find (they haven't been made for about 35 years) so I think that others might want to build accurate copies. Mine is the version of the Matchbox that is conservatively rated at 275 watts (a kilowatt-rated model was also manufactured).

"The Real McCoy" may be hard to find but dedicated hams can build accurate working copies."

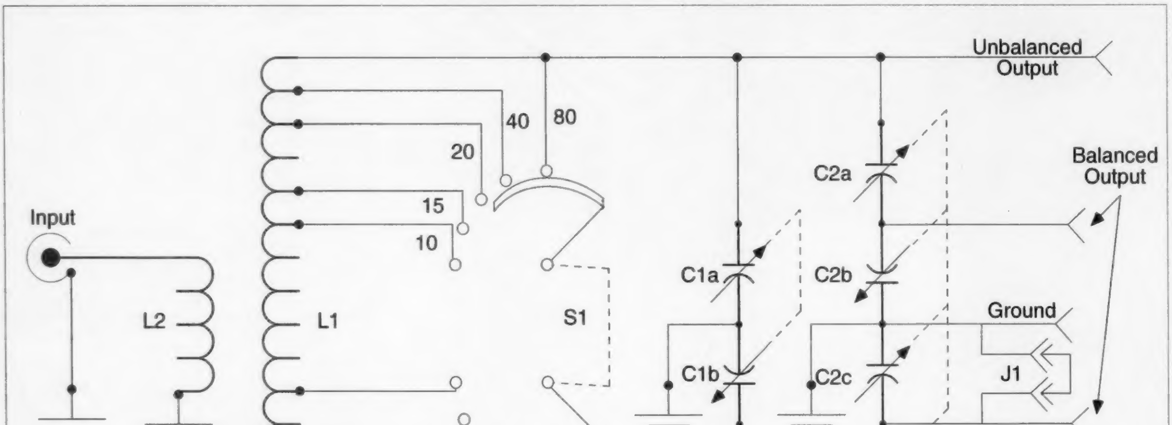
Main Coil

The construction of the main coil (L1) is unusual; the two ends of the coil are wound with a smaller turn spacing than the middle section. The coil is symmetrical in construction as it is intended to be connected to a balanced line. The pitch of the two end sections is 8.5 turns per inch. This is equal to a center-to-center wire spacing, between adjacent turns, of about 0.12 inch. Each end of the coil contains 14.75 turns.

The pitch of the center section changes to 4.3 turns per inch in about one-quarter turn (90°) of the coil. This gives a center-to-center wire spacing between adjacent turns of about 0.23 inch. The center portion contains 5 turns.

The length of the entire coil (two end sections plus center section) is 4.5 inches; its outside diameter is 2.7 inches. The entire coil is air wound on

Continued on page 47



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Ham Radio and Summer School

The 1995 session at Sno-Isle.

Larry R. Luchi W7KZE
P.O. Box 1612
Mukilteo WA 98275

I was hooked after being introduced to amateur radio in the sixth grade, and have been licensed for more than 40 years; the 1980s brought a career change, and now, as an Electronics Technology instructor at Sno-Isle Skills Center in Everett, Washington, I spend my time teaching my hobby.

The Skills Center, serving 25 area high schools, is the largest of nine Skills Centers in the state, with 22 vocational training programs for approximately 850 students. The school's name comes from the combination of Snohomish and Island counties. From the school one can see the Olympic Mountains to the west and the majestic North Cascades to the east, just 25 miles north of Seattle.

Some students take the ferry from Island county and others are bused from the 13 school districts served by Sno-Isle, for two three-hour blocks of daily instruction (a morning class and an afternoon class). These students receive three elective credits per school year for their training. In the third quarter of this two-year program, I teach amateur radio (communications electronics). All of my students have Novice, Technician Plus, or higher-level licenses by the time they graduate from high school.

Photo A. *Sarah, Larry W7KZE, Allan Falkner, talking with Frank W8OK on 20m. Visoth Sieu looking on.*

For the past 10 years I have also taught a summer school course in ham radio. My summer school course not only helps kids to get their amateur radio licenses, but also introduces them to electronics in a hands-on training environment.

> ***"My summer school course not only helps kids to get their amateur radio licenses, but also introduces them to electronics in a hands-on training environment."***

Summer school is fun. The superintendent of public instruction allocates funds each year for a 90-hour, one-half credit course of instruction for students from the ninth through the twelfth grades. The only costs to the students are bus fare and lunch.

About five years ago, while teaching summer school, I had the pleasure of meeting the Guru of the Dayton Amateur Radio Association, Frank Schwab W8OK. Frank was visiting his daughter, Pat Anderson, and family in nearby Lake Stevens. (Pat is one of 12 children; I asked Frank how he had time to help create the Dayton Hamvention in 1958 with all those kids!)

This year's projects

Summer school this year had 19 students. As usual, I asked all my students to tell the class about themselves and why they are attending summer school. To my surprise the first student was Sarah Anderson, Frank W8OK's granddaughter. The second student to speak up was Allen Falkner; his parents, James and Phoebe Falkner, WA7VQO and KA7WPG, wanted him to become part of a "ham family." After the introductions, I explained the course of instruction and issued each student a copy of *Luchi's No-Code Technician Class License Guide.* Soldering was the first skill that each student was to master; then we moved on to the code.

I used *Super Morse* on my PC. To the kids it was almost the same as a video game. Ninth-graders Sarah Anderson and Dustin Hebner mastered this approach to learning the code quickly. They both passed the 5 wpm exam at our volunteer examiners' session.

To add to the fun, I gave the kids two kits to build and take home at the end of school. One was a code practice oscillator kit. John Fluke Manufacturing Company donates these kits each year to my program, complete with a printed circuit board. The second project was an AM-FM receiver kit that the students built. This provided a break between code practice, rules, regulations and electronics theory lectures, and gave the students some hands-on training.

I also organized the kids into work teams. One team replaced N-connectors on our AOP Oscar antenna array while another team relocated our AEA IsoPole 2 meter antenna and replaced the PL-259 coaxial connectors. All the students rotated jobs to receive as much exposure as possible to the different aspects of ham radio.

Back to the ham shack for a schedule with Sarah's grandfather, Frank W8OK, on 20 meters. Now it was time for on-the-air practice. Sarah eagerly waited to talk to her grandfather. W8OK came through with a 59 signal. He gave us a 57 for my Kenwood TS-50 to a four-band three element beam. Sarah was the first to exchange greetings with Frank, followed by the other students. Only one student was a little mike shy.

On the final day of summer school, certificates of completion were passed out as our volunteer examiners prepared the test. Sarah, Dustin and Matt Watson passed their 5 wpm test. Seven students passed the code and Elements 2 and 3A for their Technician-Plus licenses, and three passed Elements 2 and 3A for their no-code Technician licenses. Summer school 1995 thus was a very rewarding experience for me and my students.

After all exams were graded we held our final schedule with W8OK on 14,270-kHz. Frank came through with a strong signal and one question. "How did the test go?" I handed the mike to Sarah and she told her grandpa the good news. Then all of the students made their first QSO with W8OK. Frank talked to our Elmers and thanked them for all of their help.

Our summer school ham radio program was successful, with help from the electronics industry and Elmers from the community. Del Talf W7EVI, who was first licensed in 1935, and Dave Johnson NJ7Z and Jeff Fasulo N1HBQ, both from Boeing, completed our VE team. These Elmers gave the kids the help and encouragement they needed to become good amateur radio operators.

Photos by Bob Higbee, Sno-Isle Skills Center counselor.

EVERETT
NEW YORK
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Photo B. *Sarah Anderson (left), W7KZE with son Anthony (right), Visoth Sieu. Note: Sarah is looking at her mother as Frank attempts to tell Pat (Sarah's mother) which is his favored daughter.*

Publisher's Note:

Permission is granted to copy this article for use in influencing school boards and administrators on the value of adding a course in modern communications technology to their curriculum, summer and winter.

Since we're well into the electronic age, this is a terrible time to keep our kids ignorant of the fundamentals of electronics and radio. These are the days of digital compact discs, of digital television, digital cameras, digital broadcast radio, direct satellite broadcasting, paging services, cellular phones, security systems, global fax, and the world wide web. Amateur radio provides an exciting and fun way of learning the basics of these technologies, with our network of thousands of repeaters covering the country (and in over a hundred other countries), with our digital packet networks, our bulletin board services (BBS), and our two-dozen-plus ham satellites.

Amateur radio and computer technology have come together with weather satellite pictures, slow scan TV, packet, radio-teletype, and high speed Morse Code contacts.

Electronics runs our typewriters, our manufacturing machines, our cars, our watches, our offices, and even our kitchens. Medical electronics is a huge business today. Thus, the earlier kids can learn to understand the fundamentals of electricity and electronics, the better opportunity they're going to have to cope with the information age. And what better way to learn than by having fun every inch of the way via amateur radio?

A knowledge of electronics provides a tremendous boost in self esteem for kids. They learn hands-on by building kits. They build confidence in communicating with people by talking with hams in almost 400 different countries. They learn about geography. Most people may not have a clue as to where Lesotho is, but hams even know the radio prefix (7P8). Look up 7P8CA and you'll find that's me! Because of my interest in amateur radio I've operated from Swaziland, Sarawak, Sabah, Sweden, Spain, South Korea, Syria, Switzerland, Sudan, Sri Lanka, South Africa, Singapore, Scotland, St. Pierre, St. Lucia, and other wonderful places around the world. I was FO8AS on Tahiti, VR2FD on Fiji, 5W4AS on Western Samoa, JY8AA in Jordan, and so on.

Speaking of Jordan, the reason that country is the foremost in technology in the Arab world is because the king (JY1) has set up amateur radio stations and clubs in almost every school in the country. How has Japan beat us so thoroughly in so many electronic industries? Every school in Japan has an amateur radio club. There are over twice as many Japanese radio amateurs as Americans, with half our population. When I visit the Japanese electronic research laboratories, I'm greeted by radio amateurs at every turn.

Every American youngster should be taught about electricity, and what better way than via a hobby which provides a lifetime of fun, learning and adventure? It can also be one of the more inexpensive hobbies, with kits and used equipment keeping the cost low. There are hundreds of "hamfests" all around the country where hams get together to swap equipment and parts.

Youngsters of four have gotten their Novice licenses, and girls of seven have attained the Extra Class license, the highest class available, so the hobby is open to kids of all ages. The only thing lacking is the opportunity for kids to get together with older hams as teachers. That's up to local schools to organize. They will find no shortage of local ham volunteers to mentor the kids. We call it "elmering."

Alaskan Amateurs and Their Antennas

Amateur radio way up North.

George Pataki WB2AQC
84-87 Kendrick Place
Jamaica NY 11432

In the summer of 1994 I toured Alaska. In 29 days I visited more than 90 hams in 15 different localities, and I took more than 640 photographs. I wanted to see how they cope with the weather and the unusual propagation prevailing on the top of the world. (Somebody suggested studying the correlation between the long winter nights and population growth, but I decided that is none of my business. I don't care what they do in the privacy of their igloos, as long they answer my QSL cards.)

Some facts of life up north were as I expected; others were revelations. I knew, for example, that the Aurora Borealis, or Northern Lights, can wipe out radio communications even during the best propagation periods, but the thing that most surprised me was the very warm weather I encountered in the Fairbanks vicinity, at about 100 miles south of the Arctic Circle. I also found out that the seemingly endless rain in Southeastern Alaska can be very depressing, but I will focus here on a single subject: the antennas used by Alaskan hams.

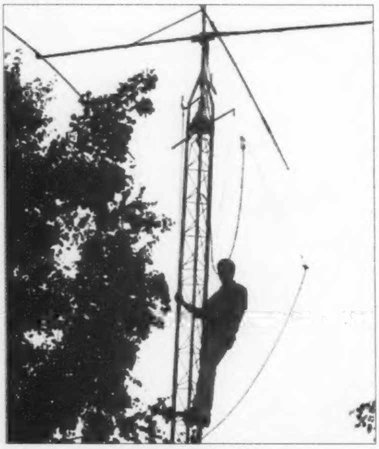

Photo A. Bill KL7ITI in Anchorage.

> ***"Radio communications is not just a hobby; it is an everyday necessity."***

First, as can be expected, the antennas, towers, rotators and cables have to be ordered from suppliers in the "Lower 48" states, or occasionally from Canada. Everything has to be shipped long distances and costs go up. Then, because of strong winds, the antennas have to be well built and the towers have to be secured with strong guy wires. I didn't see one single quad antenna, which is an excellent performer, but doesn't resist high winds well. I noticed many wire dipoles, especially for the 40, 80, and 160 meter bands.

Has anybody seen my yagi?

The vast majority of the antennas for the 10 to 40 meter bands I saw were three- to six-element yagis. Most of the antennas were installed on tall, well anchored towers, a few on steel pipes. In Anchorage I saw three-element yagi type antennas of Bill KL7ITI; Harvey NL7DK; Rick KL7YF and his wife NL7DL; Chuck KL7PJ and his wife Marge KL7YG. Simon NL7VR and his family of hams are using a five-element tribander. John KL7GNP runs the Alaskan QSL bureau, and uses a six-element beam. Harley KL7IZZ and his spouse Arlene KL7HO share a huge six- element tribander.

On the roof of the five-story Pioneers' Home, a retirement and nursing home in Anchorage, is a three element tribander connected both to the club station and to the private station of Allen KL7GU. Jim KL7CC has not one but two towers in his backyard; each supports various yagis with three, five and seven elements, and some wire antennas.

The most fascinating antenna I saw in Anchorage was built by Mike KL7X. It consists of four groups of four yagis, each with six elements, and is used for Earth-Moon-Earth communications. Mike worked 30 DX countries and almost finished his Worked All States on EME.

In Palmer, Nate KL7DJE installed his six-element tribander, as well as a couple of other antennas, on a tower that seems to be about 70 feet tall. In the back yard of Bob NL7ZG, the president of the Mat-Su amateur radio club, besides a four-element beam, I saw a complex antenna, possible for EME communications. Unfortunately, Bob was not at home, so I couldn't learn anything about his antennas.

In nearby Eagle River, Hannelore NL7EA and her husband Mark KL7TQ use a six-element yagi.

Also using a six-element beam are Bob KL7AM and his wife Luisa WL7BNX in Fairbanks. In the same city, Chuck K7JUT/KL7 has a four-element tribander, mounted on a self-supporting 70-foot tower.

In the town of North Pole, up the road from Fairbanks, Eric KL7AJ and his 16-year-old son David WL7NK operate with a three-element beam installed on the top of a 30-foot steel pipe. Not far away is Joel WL7AI; he has a three-element yagi and his repeater antenna on a very tall and well-anchored tower. Also residing in North Pole is the ham family of Ed KL7XD, his wife Sandy WL7PQ, daughter Danielle WL7QW, and two sons, Bill KL7TC and Mike KL7YY. They have two large towers, each with a couple of yagis.

The most fantastic setup I ever saw belongs to Rich KL7RA, on a 20-acre estate in Chena Hot Springs. His contest station has seven towers, some of them over 200 feet tall, each with beam antennas for a different band.

The club station of the US Coast Guard Station in Kodiak, KL7HKX, has two towers; one with a seven-element yagi, the other with two antennas: a four- and a three-element beam. Both antennas are connected to the station with underground cables. Mike KL7JBV, Chief of the Kodiak Fire Department, has a tower and a five-element tribander. Chuck WL7EM easily climbs up his anchored tower, about 60 feet high, to reach his three-element tribander. Also in Kodiak, Henry KL7ALJ has a six-element yagi on top of a 70-foot solidly-anchored wooden pole.

In Juneau, the state capital, Rick N6IV/KL7 shares a three-element tribander with Herb WL7BIL and his spouse Cynthia KL7IZE.

In Auke Bay, George W3ML/KL7 has a four-element tribander on top of a tower erected on the shores of Auke Lake.

In Sitka, Sal KL7BJC has a four-element beam; Leo NL7XW is using a three-element tribander; and Bill AL7KX has a four-element yagi and a couple of other antennas on the same tower.

In Petersburg, Ed KL7DYS and his wife Mildred WL7ALG share their six-element tribander. Their house, with the tower and beam, is only a couple of yards from the water of the Inside Passage, which should make radio communications easy.

In Ketchikan, Chris KL7GIH has a six-element beam for 6 meters, his favorite band, and a wire antenna for 160 meters. Hank KL7IBG uses a five-element tribander.

A seldom-seen antenna is the one designed for satellite communications. Simon NL7VR has one in his back yard and is using it for Oscar-13. A similar setup is the antenna system operated by Jim KL7CC. Both of these hams live in Anchorage, the largest city in Alaska, where most of the active amateurs reside.

Rubber Duckie, you're the one!

In Alaska, recreational vehicles and boats are everywhere, and every one is equipped with some sort of radio. Buildings bristle with vertical antennas, most of them used by CBers, and in the coastal towns, for marine radios. Radio communications is not just a hobby; it is an everyday necessity.

The most commonly used antennas in Alaska are the little rubber duckies. Technician licensees cannot yack on the lower bands, and nowadays 10 meters is rarely usable, so they limit themselves to HTs and operate on 2 meters and 70 cm. Even the higher category ham operators have, besides the big station at home and small ones in their car, truck, boat or plane, one or more HTs. In some instances, when there are several hams in a family, everyone uses them.

In Kodiak at the US Coast Guard station I met Dean WL7RK, a helicopter pilot, his wife Alesia WL7RL, and their son Brian WL7RJ. All three have their own HTs and dune buggies; they travel convoy style, and they are in constant radio contact even when they are only a few feet apart.

Joe WL7AML, in Kodiak, can use his HT with the rubber duckie to talk with hams in Homer, 140 miles away. The trick is that he has to climb on Pillar Mountain and place his radio in the proper position in front of a 60- by 60-foot dish abandoned by the military. A little duckie can do wonders in the right setting.

Matt WL7LX, in Petersburg, may leave home without his American Express card, but never without his HT. It's used on his little boat when he's going fishing, in the bush when he's hunting, and it's small enough to run with if he spots a bear.

The USCG Cutter *Sherman* I saw in Juneau is equipped with all kinds of antennas and sophisticated communications gear. However, crew member Slade KC4WVL uses his little HT with a modest rubber duckie to contact other hams wherever the ship takes him.

Other frequently seen amateur radio antennas are the 2 meter and the dual-band mobile antennas installed on cars, pickups, motorhomes, and boats. Dave KL7M is a taxi driver in Anchorage and makes QSOs while working. Joe NL7RX, in the same city, works on a tow truck; I had a contact with him while he was picking up a wrecked car.

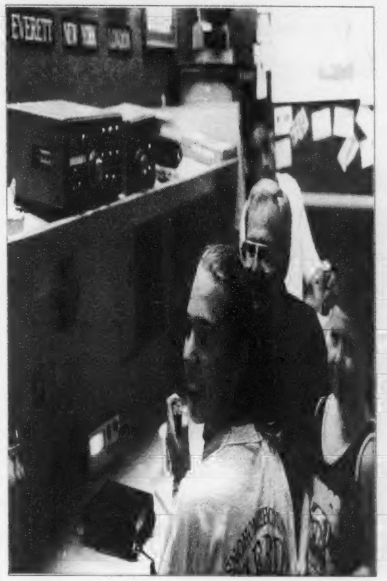
Photo B. *Chuck K7JUT/KL7 in Fairbanks.*

Verticals for amateur radio? I saw just a few. In Kodiak one is used by Curt AL7LQ; in Juneau by Don WL7ME, and by his neighbor Curtis WL7PX; in Homer by Clarence W0URD/KL7; in Palmer by Jack AL7HN; in Sitka by Hal KL7BCS; in Petersburg by Ed WL7CFZ; in Wrangell by Bob KL7JCZ and by Doug WL7LR.

Solid radio contacts, besides needing good operational skills, favorable

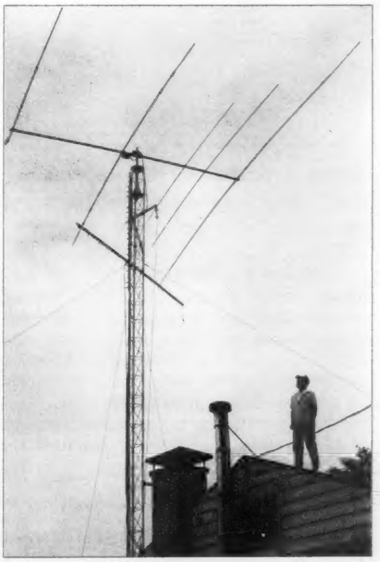
Photo C. *Bill AL7KX in Sitka.*

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Photo D. Bill KL7TC in North Pole.

location and propagation, also require reliable equipment: antennas, receivers and transmitters. Of all the investments an amateur radio operator can make, the choice of antenna is the most important, and Alaskan hams know it well. Remember, however, the old saying: If your antenna didn't fall last winter, it wasn't high enough.

The photographs show some of the antennas I saw in Alaska, but keep in mind that these little photos cannot begin to show the real scope of a 100- or 200-foot tower with a couple of huge five- or seven-element yagis on the top! 73

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Easy to Build 10m

Continued from page 23

coax from dipole assemblies #3 and #4. Connect the last 5' 5-1/2" coax into the coax "T" and terminate the coax into the SO-239 chassis mount on dipole #1. Complete the assembly by connecting transmission feedline into the center terminal of the coax "T" using a PL-258 coupler.

Parts List

24	PVC Schedule 40 1/2" "T" plastic lawn sprinkler fittings
24	PVC Schedule 40 1/2" 1-inch long plastic pipe sections
12	3" adjustable stainless steel hose clamps
4	1 x 1 6' aluminum angle (for the element support)
4	1/2" x 10' aluminum tubing for the elements
4	3"X2" 3/16" thick Plexiglas™
2	"U" bolt type clamps
4	SO-239 chassis mounts for RG-8U coax
3	M-358 "T" coax adapters
1	M-359 right angle adapter
1	PL-258 coupler
16	Phillips 3/4 inch long sheet metal screws
1	Small can of PVC cement
3	Lengths of RG-8U, each 1/4 wave long, PL-259 connector at each end
2	Lengths of RG-8U, each 1/2 wave long, PL-259 connector at each end
1	Suitable 10-foot boom

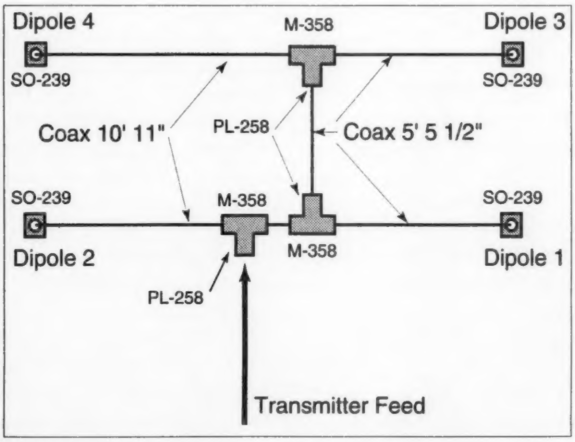

Fig. 3. The coax road map.

NEVER SAY DIE

Continued from page 25

published in past issues of *73* just because you don't keep my thousand-plus old editorials on file and cross indexed. Most of the stuff in my booklets originally appeared in my editorials at one time or another.

Can I get you to think things over and decide to make some major changes in your life? A diet change for you and your family will eliminate the problem of degenerative illnesses. It means eating different food and water, and adding the vitamins and minerals that have long been gone from our soil. It means daily exercise. Maybe a job change to something more fun. Some ham radio challenges…like perhaps getting on the ham satellites. How about finding a better school for your kids? Most public schools suck.

Are there some skills you'd like to build? Books you'd like to read? TV you can do without? In the long run will you be better off for having watched a rented old movie or in reading a book? Or is what you're doing today so much more important to you than your quality of life ten, twenty or 50 years from now?

Continued on page 37

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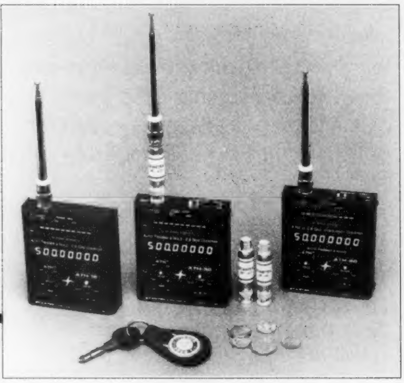
73 Review

Startek ATH-50 Frequency Counter

Functions, features, and fun!



Larry R. Antonuk WB9RRT
P.O. Box 452
Marlborough NH 03458

Now that the prices of some handheld frequency counters are dropping to the $100 range, more and more hams are finding themselves in the market for one. Let's look at the ATH-50 Counter from International. This top-of-the-line unit has all the functions and features you could want in a piece of handheld equipment. By reviewing each of these functions you'll be able to decide which ones are more important for your application, and you'll be able to make a more informed decision when you make your frequency counter purchase.

The basics

At the basic level, frequency counters do just what you'd expect—they count frequencies. The first question you need to ask is, "What frequencies do I need to count?" As a general rule, the higher the frequency you need to count, the more deluxe the frequency counter needed, and the higher the price. The ATH-50 will count frequencies up to 2.8 GHz, making it useful for work on the 23 cm band, as well as on 2.3 and 2.39 GHz.

If you don't venture beyond 2 meters you might be totally happy with one of the other units in the line that have a high limit of 1200 or 1500 MHz. However, one point that is frequently overlooked is the low side of the frequency range. While most of the line starts counting at 1 MHz, the ATH-50 has a low range limit of 5 Hz! This means that in addition to being a full-featured RF frequency counter, this unit can perform audio functions, making it ideal for checking and adjusting CTCSS encoders, DTMF encoders and decoders, checking packet modem tones—anything down to a resolution of 1 Hz. This low frequency mode is only available on the ATH-50, but it might be well worth the money in your particular application, even if you're sure you're never going to venture beyond 2 meters.

The next specification to check out is the unit's sensitivity. Compared to a receiver, a frequency counter is a fairly low-sensitivity device. By design, a frequency counter operates mainly in the near-field region of a transmitter. (The near field translates to about a hundred feet for a 2 meter handheld.) This means that the strongest signal wins—and gets counted. How else could the counter differentiate between the hundreds of weak signals available between 5 Hz and 2.8 GHz bombarding its antenna?

On the other hand, if the counter isn't sensitive enough, it won't be able to count a frequency until you're right on top of the transmitter. This would be okay for some test bench applications, but pretty useless for fox hunting or investigative work. The ATH-50's sensitivity varies with the frequency being counted, but for most of the bands of interest (10 - 800 MHz) the sensitivity is less than 2 mV.

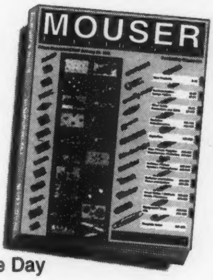
This sensitivity represents a good compromise between the ability to count distant signals and the disadvantage of hearing too many signals so the counter becomes confused. Depending on your application you may choose to select a unit with a higher or lower sensitivity, or you might choose to add an accessory that will increase the "effective sensitivity" of the unit on a given band. We'll discuss those accessories later on.

Another feature to consider when buying a counter is the type of gating used. Gating is simply the counter's method of letting a certain amount of signal pass into the counter circuitry at a given time, in order to measure it properly. All counters use a hardware gating circuit that controls the gating based on signal level, just like high-end professional counters. This produces an extremely fast response time, on the order of 80 ms to gate, capture, count, and display an accurate frequency.

In contrast, some microprocessor-based counters use a sample-and-compare method, meaning that successive samples are compared until a match is found (or several matches in a row) and then the match is displayed as the correct frequency. While a valid method, the sample-and-compare counters can't match the fast response times of the hardware-gated counters. Again, this may not be a problem on the test bench, but it may be an issue when DFing a repeater jammer or tracking down an elusive intermod product.

It's easy to focus on the off-the-air performance of a frequency counter and totally forget the in-circuit uses of the device. Counters are quite handy for measuring the frequency of in-circuit oscillators, both in receivers and transmitters.

"This makes it very easy to capture frequencies without even looking at the display, eliminating the need to jot down frequencies as soon as they're counted."



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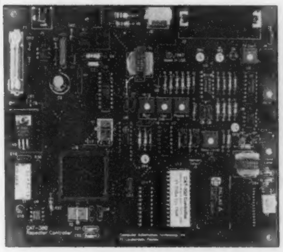

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CIRCLE 268 ON READER SERVICE CARD

NEVER SAY DIE
Continued from page 35

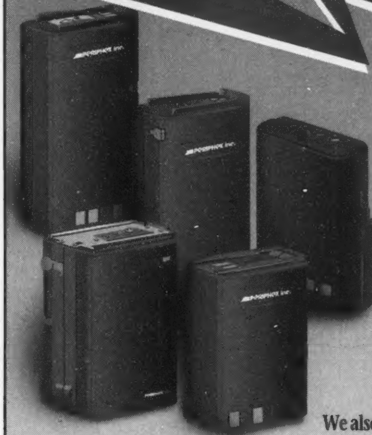
I have so much I want to do that I could fill a 300-hour week. I've recently read some fabulous books I want to tell you about. And I've got a bunch more stacked up to read. I want to set up a small lab and do some research for a new product that every person in the world will want to buy. It's a product that will help every person who buys it to be healthier and live longer. The FDA will hate it, as will the AMA, the National Cancer Institute, the NIH, AIDS activists, the Medicare and Medicaid bureaucracy, and so on.

That's what I plan to do. Now, how about you?

Bug opportunity

I sure wish I had a bunch more readers like Alan Glowinski WA9EVE. Alan sent me some great newspaper clippings. One on several families whose kids died of leukemia from living near power lines, another on a micropower impulse radar

Continued on page 39



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CIRCLE 68 ON READER SERVICE CARD

Unfortunately, you can't simply hook a scope probe up to your counter and start probing around in your receiver; the 50 ohm input impedance of the counter will load down the higher-impedance oscillator circuit, causing it to "pull" the crystal off frequency or kill the oscillations entirely. The ATH-50 has a special high-impedance mode on the 5 Hz to 50 MHz range that allows you to use the counter in-circuit, without disturbing the circuit under test. This 1 megohm impedance is the same value as that found on Tektronix scopes, and can be used under the same circumstances.

Don't forget the physical characteristics when considering a counter. The counters all sport high-efficiency, high-brightness LEDs. Easily readable from across the room, they're also readable in broad daylight—and they take the same or less current than comparable LCD counters.

The ATH-50 and all the models come packaged in anodized aluminum cases, utilizing threaded machine screw bushings. (If you expect to give it more abuse than the case can take, just pick up the optional carrying case.) And last but not least, always consider the worst case scenario. What if the thing breaks? All counters are covered by a 5 year parts / 1 year labor warranty - and the high-intensity LED's are covered for 5 years, parts and labor.

The frills

Once you've determined which basic frequency counter features are important to you, it's time to check out the more advanced features. The ATH-50 has several functions that make using it an enjoyable experience. The first of these is the built-in bar graph RF signal strength meter. While a field strength meter is nothing new, they have only recently begun to be incorporated in frequency counter designs. The field strength meters consist of a ten-segment LED bar graph, located right above the main display.

The bar graph display operates independently of the counter, and displays the level of the strongest signal present. Perhaps the most common use of this signal strength indicator is to tell the operator when the counter has enough signal for a good reading.

Another excellent use of the RF signal strength meter would be during a foxhunt. Small, lightweight, easy to see in the dark, quick responding—these counters would be great for use during the "end game" of the hunt. In addition to giving a field strength indication, the counter display will give a confirmation that you're homing in on the proper carrier, in those cases where the fox is hidden near a second transmitter.

The feature that makes the most difference in daily operation, and the one that really differentiates the ATH-50 from most bench-style counters, is the Automatic Trigger and Hold Circuitry. Rather than returning to zeros after displaying a signal, counters with the ATH function hold the last valid count until the next signal comes in.

This makes it very easy to capture frequencies without even looking at the display, eliminating the need to jot down frequencies as soon as they're counted. An automatic clean dropout feature ensures that a valid count is received before the last count is overwritten, to prevent "garbage" displays.

"Yikes! The local FM broadcast station was at this site!"

The ATH function, combined with the 80 ms response time of this counter, makes it possible to capture frequencies that would totally escape detection without these features. The ATH-50 also has a simple hold switch which locks the current display until the switch is changed, and a one-shot mode that operates in conjunction with the ATH mode except that it locks on and holds the first valid frequency, and holds that frequency until reset, regardless of subsequent signals.

The add-ons

It's time to consider the available accessories. The accessories most likely to enhance the operation of your counter are band pass filters. These small filters are installed in line with the counter's antenna, and pass a band of frequencies of interest.

Suppose you're trying to use a frequency counter at a crowded mountaintop radio site. You want to count the frequency of a 440 MHz ham repeater, but the frequency counter is confused. It hears the 440 MHz machine all right, but it also hears the 30 MHz paging transmitter, the 155 MHz police base, the 72 MHz RF link, and several of the 800 MHz cellular phone channels. By installing the proper band pass filter, most or all of these other signals can be reduced or eliminated, allowing the counter to produce a valid count on the band of choice.

Band pass filters are also useful for general off-the-air counting, anytime you know what band you're interested in. By eliminating signals in other bands the filters reduce the overall RF noise floor, improving the effective sensitivity of the counter for the frequency you're trying to count. In difficult situations, band pass filters can make the difference between a solid count and garbage. Startek offers four different filters: DC - 60 MHz; 130 - 500 MHz; 400 - 1500 MHz; and 800 - 2000 MHz models. Each of these offers less than 1 dB of insertion loss over the passband, and attenuates out-of-band signals by at least 25 dB, and much more on some bands.

As an example of the usefulness of these filters, I was recently called upon to track down some interference on a nearby mountain. The site was fairly crowded, radio-wise, and one of the commercial 450 MHz repeaters was trashing the 2 meter ham repeater, probably because someone had mounted the commercial rig's antenna right on top of the ham antenna. Unfortunately, we couldn't tell which one was the culprit.

At the site, I flipped on the Startek—it displayed 107.9. The LED bar graph showed six or seven segments lit—a pretty healthy signal. Yikes! The local FM broadcast station was at this site!

The bandpass filters would save the day. I reached into my pack and pulled out the HP-400, which passes frequencies in the 400 to 1500 MHz range. Putting this filter in line with the antenna dropped the signal strength to one or no bars, just about eliminating the FM broadcast signal. Now the 450 MHz commercial repeaters began popping up on the display, and I was able to quickly identify the rogue transmitter.

The performance of the counters can also be improved by using an antenna tuned to the frequency band of choice. Startek offers several antennas, as well as probes, cases, and a special interface cable for the MFJ-207 Analyzer.

Frequency counters have come a long way in the last few years, in terms of both features and pricing. The Startek ATH-50 represents the finest model in the line, and would make a good choice for anyone interested in a full-featured frequency. Designed and manufactured in the USA., the unit is available from Startek International, Inc., 398 NE 38th Street, Ft. Lauderdale FL 33334. 1-800-638-8050.

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NEVER SAY DIE

Continued from page 37

system which presents endless opportunities for anyone with their antennas up looking for them. And a third, which is a real corker, on a new way to clean bacteria from water without using chemicals, heat or radiation.

This is a real simple approach which makes good sense and it's been tested and confirmed at Idaho University. So the answer to your first skeptical question is, yes, it really does work.

The process starts out by running the water through a pipe in the dark so that the bacteria shut down their defenses against ultraviolet light. Then you hit them with a 69 kHz high energy zap, which blows holes in their cell membranes. It rips the bacteria apart.

Applications: every home, swimming pools, reservoirs, public water supplies and so on. Imagine what a benefit this can be to third world countries where millions of people die every year from polluted water! There's even a hotel in Acapulco I could name that could use it in their restaurant.

Now, here's the test. Did you read the above, nod your head, and say how interesting that is; period? Or did you say to yourself, hey, there's one hell of an opportunity for almost anyone with some electronic smarts to make some bucks while helping a lot of people to keep from getting sick? Have I had any success at all in getting you to think like an entrepreneur or am I just wasting my time even trying to get you to make money and have more fun in life? Have you taken vows of poverty? Is it a religious thing?

Sigh.

In the last few days I've seen several outstanding opportunities to provide products that the world needs desperately. I just wish I had the time to make some of these things happen. For instance, one is a health product that would virtually guarantee that people could, if they had any interest, live at least 50% longer. Maybe 100%! It's inexpensive to make and could easily be set up with multilevel marketing thousands of people could make lots of money. And a few could make gobs. Watch out Bill Gates and Warren Buffet.

But I go to the trouble to read everything I can and learn about new fields. I seek out and talk with the experts, and then I go to scientific conferences so I can meet and talk with more experts. In the last year I didn't see you at the Boulder ISSSEEM conference in June. I was there. I didn't see enough of you at the Tesla Society conference in July in Colorado Springs, despite my editorials telling you about it. I was there and even gave a talk. Nor did I see you at the January '96 Global Sciences conference in Tampa, where two of the biggest technology breakthroughs of the 20th century were presented. And that isn't hyperbole.

Sure, Dayton is fun, but I can't remember when there has been one single talk there that got me to thinking and gave me ideas. If I missed any, nobody has bothered to write and tell me about it.

If you hear of any scientific conferences you think might

Continued on page 55

Number 40 on your Feedback card

Debunking Some Myths about Antennas, Feedlines & SWR

14 facts to pass along.

Bill Parker W8DMR
2738 Floribunda Drive
Columbus OH 43209

If something is repeated often enough, it will be accepted as true. Incorrect information will never be extirpated, but we can all help to reduce it by being correctly informed and knowledgeable about transmission lines and antennas. Spreading myths and misconceptions about antennas over the radio, while newcomers are monitoring, is how wrong ideas propagate.

Read as much as you can absorb. Think about what the author is trying to convey. Compare different authors' ideas. Attend club meetings that offer programs about the subject. Sooner or later, when installing an antenna or while operating with an antenna system, conditions will occur that seem to defy any and all logical explanations. You will be glad then to seek advice from anyone who will listen to your woeful tale. Here are some facts to help you tell when a misconception is being repeated and believed to be accurate. At first glance they may be hard to accept, but facts they are.

1. A low SWR indication does not necessarily mean that everything is operating properly. It does indicate that the antenna system, consisting of the transmitter, feedline, and antenna, are very close to being properly impedance–matched. Changing frequency without some change in SWR is usually cause for concern.

2. Reflected power does not flow back into the transmitter causing overheating and/or inflicting damage. Mismatched impedance essentially detunes the amplifier allowing damage to occur.

3. No transmission line must be any specific length if a transmatch (antenna tuner) is available. Varying the length of the feedline doesn't change the SWR, but it does change the impedance presented to the feedline-tuner connection.

4. At frequencies below about 35 MHz, when using open wire (low loss) feedline, signal levels due to SWRs as high as about 6:1 will be essentially the same as signals produced by a near perfect 1:1 SWR.

5. Neither the antenna or the feedline must be self-resonant to operate properly. Nearly any feedline and associated antenna may be resonated by using an antenna tuner (transmatch).

6. Using a transmatch to resonate an antenna-feedline system does not change the antenna or the feedline impedances. It provides the required inductance/capacitance to resonate the mismatched antenna system, via reactance canceling, also referred to as conjugate impedance matching.

7. Most losses in an antenna system occur in the accompanying transmission line. The ohmic losses due to very small diameter conductors are an obvious exception. Nearly all antennas are quite efficient radiators.

8. For low-loss transmission line, an SWR meter placed anywhere in the line will read the same value. At the antenna, at the transmitter, or somewhere in between yields the same reading.

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***Toon 1:** Maybe next time you could bring a copy of* Ladies' Home Journal!

Continued on page 59

73 Review

Number 41 on your Feedback card

The Alpha Delta DX-A 160-80-40 meter Twin Sloper

Okay, so you don't have a 200 acre farm.

John Stevenson AC4JO
4576 Monaco Road
Memphis TN 38117-6132

The first thing you, as a new ham, should do, is sell your house and buy enough land so you can set up a decent antenna system. Since the XYL may inexplicably veto this very practical solution to your problem, some compromises may be necessary. My yard is only 55 x 100 feet, including two pecan trees and power lines, which made the top band contacts for 5B-DXCC difficult.

> ***"The Alpha-Delta DX-A Twin Sloper is designed for 40-80-160 meters, with one leg of the sloper a quarter wave for 80 meters and the other a quarter wave for 40."***

After trying dipoles, slopers, and reading every antenna article I could find, I gave up and bought an Alpha-Delta DX-A Twin Sloper at Dayton. It is designed for 40-80-160 meters, with one leg of the sloper a quarter wave for 80 meters and the other a quarter wave for 40. It has a coil partway down to provide a quarter wave on 160. Like all slopers, the wires make one half of the antenna and the tower makes the other half. The 80 meter leg is 67 feet long. The 40 and 160 section is 70 feet. The antenna is rated for full legal power and comes preassembled.

The instruction sheet made the installation simple. I installed the predrilled center connector as high on the tower as I could, with the wires stretched sloping to the ground. My lot's shape forced me to put the two elements at about a 90° angle rather than the 180° recommended. Using my MFJ Model 249 SWR Analyzer, I easily trimmed the antenna to resonance. Both sections resonated slightly below the band edge. After trimming, I was pleased to find the antenna was 1.5:1 from 1810 to 1850, from 3750 to 3850, and from 7050 to 7250. Out of curiosity I tried out 17 meters and found it resonant just above the band.

When I got on the air the first thing I heard was 9GIBS 5/9 working split on 7075 and 7175. I worked him on the first try and got a 5/9. Then, trying 80 meters, I worked VP5/JA7MQD and XE1L, with 5/9 both ways. The next day, using a Drake MN-2000 antenna tuner, DL4VCG/HC8 and VP2EE were weak, but workable on 17 meters. I'd say it's a darned good antenna!

KPC-9612 Monitors POCSAG Paging

Kantronics has updated the KPC-9612 firmware, now V7.0, to monitor 512 and 1200 bps numeric and alphanumeric RPC1 (pocsag) paging messages. V7.0 also supports page transmissions and a packet paging server. Ten new paging commands are added. Users may connect to MYPAGE @ 1200 or 9600 to initial a page. A Pagerlog and Pagebook may be established in RAM, assisting the sysop in maintaining and the remote operator in using the page server. The Pagerlog logs all pages sent and the Pagebook stores callsign and pager capcode pairs. Paging operations require a 9600-like "data ready" radio which attaches to the 9600 port of the KPC-9612.

Data Sheets From our Website

To receive data quickly on paging with the KPC-9612, version level on the KPC-3 or KAM Plus, or product data sheets, browse our INTERNET webpage: www.kantronics.com. E-mail forms are available at the site too. New to the web? Then reach our page with your browser by clicking on FILE, clicking on OPEN LOCATION, typing in www.kantronics.com, and hitting return. If your browser program supports file downloads, you can retrieve numerous application articles too, Or, just check in to see "what's new."

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The N1IR Tree Antenna

Yes, this is *the April issue...but this is a* real *antenna, not a joke!*

Chip Cohen N1IR
2 Ledgewood Place
Belmont MA 02178

This "biological antenna" may be the most peculiar antenna you'll ever hear of . . . and it works!

In the last few years, I have been designing and building a variety of new and exotic antennas; specifically in the field of fractal antennas, which are built around those exotic shapes showing up just about everywhere. The new antenna described here was inspired by some theoretical (model-based) work, in which mathematical "fractal trees" were found to be high gain antennas. Also, I was aware that real trees had been shown to be VLF resonators about 15 years ago. In *QST* I'd seen old reports of trees poorly resonating at 40m when tuner-fed. Would they work at *any* communications frequencies? I decided to put my scientific skepticism aside and let my curiosity take over.

Fact: Real live trees *are* antennas. But before you exchange your antenna farm for a tree farm, keep in mind that real trees are mediocre-to-good antennas which only seem to work at VHF and UHF. Here's how to "build" one.

"Real live trees are *antennas."*

First, find a tree 15 to 20 feet tall. Bring your coax to the ground at the foot of the tree and firmly hammer a 1-foot ground rod into the soil about 2 inches from the trunk. Attach the braid to the ground rod. The rod should only be visible an inch or two above the soil. Next, hammer a 1-inch nail into the trunk, about 2-4 inches up and close to the ground rod. Connect the center conductor onto the nail. If you wish, you may place a ferrite collar at the feed to assure that it's your tree that's radiating. See Photos A and B, which show my connection to a 20-foot oak tree, and the tree antenna itself.

Now go and operate. You will find that the "tree antenna" resonates broadly (less than 2:1 SWR) from about 120-175 MHz for a 50 ohm feed. It is mostly resistive, and not reactive, near 2m. You'll have a 2m antenna—without the antenna! The tree antenna seems to perform roughly 2 dB better than a 1/4-wave duckie (based on a direct comparison). Don't expect it to perform like a high ground plane, though—it will easily be 8-12 dB below even a modest, raised commercial ground plane vertical antenna. A true gain antenna it's not—but it's nature's free gift to the VHFer. Here, near Boston, my tree antenna is on a hill and I get into the Derry, NH, repeater (K1MNS) and the Carlisle, MA, repeater (W1FC) full-quieting with 1 watt. That's 40-45 miles away. Same story with DX packet on K1EA, which easily connects from 35 miles with a watt. My results may not be typical, though, because of my elevation. If there's a repeater 10-15 miles away, a tree antenna should be adequate in most locations.

To double-check my results I had to establish that it was the *tree* radiating, and not the coax (all of which was on the ground). I loaded the ground only; no dice. Then I disconnected the hot conductor from the tree and watched the signal go away. I fed the tree with different lengths of coax—from 1 inch to 100 feet—and noted the (minor) SWR changes. The MFJ 259 SWR analyzer

Photo A. *The author's connection to a 20-foot oak tree.*

was handy for this. I minimized the length of unshielded coax at the feed to a few inches or less; a very high SWR would show *this* to be the radiator. Finally, I placed a ferrite collar on the coax at the tree to stop coaxial radiation, and then used an IC Engineering field strength meter on a pole to confirm that the radiation was emerging from the tree and not the ground. Maximum near-field readings came from the lower trunk and upper branches.

The tree seems to resonate by virtue of its height. This might also be expressed by its trunk diameter, since a thick trunk goes with a high tree. I found, roughly, that the resonant frequency goes as the formula:

$$f = 150\,(D)^{-0.20}\ \text{MHz} \quad [1]$$

for D, the trunk diameter, in inches. The resonance is of very low Q. I measured a Q of about 3 for several different trees (mostly maples and oaks) . The lowest resonance I attained was about 100 MHz for a 1-1/2 foot (trunk diameter) oak tree. Keep in mind that I had no equipment capable of checking VLF resonances, just as I suspect that the previous investigations had not checked out VHF possibilities. The tree worked poorly when fed by a tuner on 40m and 20m; it was basically a dummy load at HF.

To explain the tree radiator, it is tempting to use fractal theory. Such a broad resonance radiator could easily be explained by a "multifractal spectrum," indicating that the real tree is not just one fractal pattern, but a variety of patterns akin to one another (clouds are a great example of something with a multifractal spectrum). It is not known to what degree the roots function as "radials." Further work needs to be done to show how the fractality of real trees affects their characteristics as antennas, if at all. Unlike the fractal tree antenna, the real tree antenna is capacitively loading the feed, and is not high in gain.

Why use a tree antenna? Aside from the novelty, a tree antenna is the ultimate stealth antenna. If your neighbor complains about a radiating tree, it's time to cart him off to the funny farm. Imagine the "no antenna" controversy in your town erupting over trees. Time to pull them all down—or defer to the intent of PRB-1! Seriously, though, it is a good emergency antenna, and may be useful for RC-controlled lawn and patio electronics, among other things. And will there be a tree-based repeater soon?

A few cautions: First, *never* use high power on the tree; it could result in a fire. Next, be aware that rain and snow will undoubtedly (temporarily) short out the antenna, or at least change the SWR. Ground conditions also change the resonant frequency, but the resonance is so broad that you will experience only minor 50Ω SWR changes (mine was 1.3:1 at 2M) after it rains.

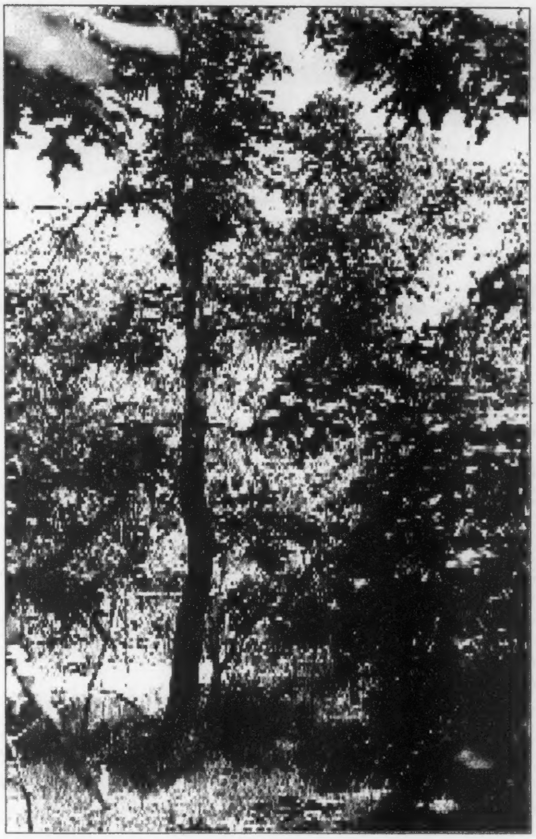

Photo B. The tree antenna itself.

> ***"The tree antenna seems to perform roughly 2 dB better than a 1/4-wave duckie."***

Also, if you *depend* on your VHF link, try a backup antenna (or make the tree your backup). Finally, I am not suggesting a new scientific field where you: "plug in a petunia," or "radiate the radishes." Anything that's water-based will radiate (or at least load)—usually poorly. Because they are tall, stationary, grounded, and don't complain, trees make the best "biological antennas."

On a practical note: *Trees are resonant structures*. Therefore, at VHF and UHF, it's best to get as far *above* and away from them as possible. Your backyard forest is not transparent to RF.

Does being an antenna do anything for the tree? Probably not. Note, however, that trees do *not* resonate well at LF, HF and MF. It is at these frequencies that much of the energy from lightning is discharged. Could being a poor low-frequency radiator help a tree survive lightning strikes? We will never know—unless trees start doing something bizarre, like talking back. And if they do....I'm not listening! 73

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73 Review

Number 44 on your Feedback card

The ISOTRON 80

Good things come in small packages.

Jim Bellini K9HKS
817 East 15th Street
Sterling IL 61081

As most of the ham radio community is aware, the amateur bands were not at their best during the months of October and November of 1995. So was that a good time to try to evaluate an antenna? Well, after thinking about it, I believe it was! If it will work under poor conditions we all know it is going to *really* perform under great conditions!

I received a letter from Ralph Bilal asking me if I would like to review one of his ISOTRON antennas and compare it to other antennas that I have had at this location. I jumped at the chance because I have seen the ISOTRON antennas advertised and, frankly, I thought that they were kind of an odd-looking antenna—too small to be effective and, at most, good for someone in an apartment, operating portable, or perhaps in a mobile home park. Was I surprised! (More about that later.)

Ralph said he would send me the ISOTRON 80 antenna, as I happen to be very active on 75 meter SSB. By the way, I have been a ham for about 40 years, so I think I have seen and tried almost every type of antenna that has come along. I especially like to make wire antennas: loops, longwire, dipoles, curtains, etc., and anything that is out of the ordinary. Looking at the picture of the ISOTRON 80, it certainly fits into the out-of-the-ordinary category!

Assembly

About a week passed and I was at home on my lunch break when the UPS truck pulled up. The driver handed me a box that looked too small to contain an 80 meter antenna and that felt as if it must be a box of feathers—it weighed scarcely 6 pounds! I quickly opened the box and, to my surprise, there was hardly anything in it that even came close to looking like an 80 meter antenna. Everything was neatly packaged; nothing rattled around in the box. In fact, each little package was secured to the box with some kind of epoxy. Looking at the contents I admit I kind of chuckled and thought: This is not going to be much of a test—it's too small to do much on this band.

Later that evening I read the assembly instructions and decided that since it was so small I would put it together in the basement. Downstairs we went and in about 20 minutes I had this strange-looking antenna put together.

> ***"This antenna is not just something to use until you can get a* real *antenna—it truly is a real antenna and I would recommend it for any permanent station."***

Operation

Well, what now? I had a 10-foot piece of coax so I decided to hook it to the antenna and my TS-440S. To my surprise, the signals were pretty good in spite of being in the basement with an antenna that didn't look like it would do anything on 75 meters (it looked more like a 2 meter antenna).

The next day I considered trying to get the antenna outside and on the tower, but there was about a week of windy, rainy weather, so there was no chance to work with the antenna. I kept looking at it and wondering if I was wasting my time, but my curiosity was getting the best of me. Out to the garage I went and found a couple of sections of TV mast pipe. I put them together and fastened the ISOTRON 80 to the mast pipe. The wind was still blowing and the temperature was around 25°F, so I had to make quick work of getting this antenna into a position where I could see if it would do anything at 20 feet.

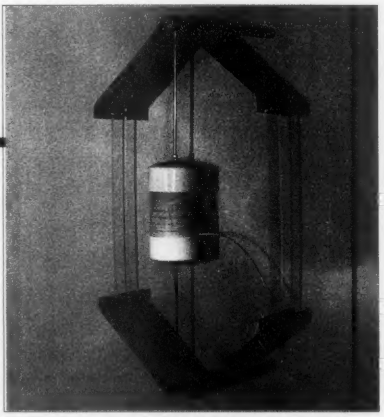

Photo A. The ISOTRON 80. Photo by Will Sosa.

I took a couple of sawhorses and made a support to hold the 20 feet of mast and antenna up in the air in the middle of the back yard. It wasn't pretty, but at least it was off the ground.

Back to the basement and the rig. Signals were not bad considering the conditions. I wondered where the resonant frequency was going to be. According to the instructions, without the tuning stubs the antenna should come into resonance around the high end of the band. Much to my surprise, without any adjusting the resonant frequency was 3.940 with a 1.1 to 1. So would the signal get out when the antenna was only 20 feet off the ground?

I was able to work several stations with 58 59 57 reports in the middle of the afternoon. I was interested to see what the signals would be when I checked into the Mid States WX net meeting on 3.940 at 6 p.m. CST that evening. I have been on this net for many years and most of the fellows know what my signal should be. No one seemed to notice any difference in the signal! When I told them what I was using, there was the same disbelief that I had felt when I first saw the antenna.

Switching between the dipole and the ISOTRON, I noticed that the ISOTRON didn't seem to pick up as much noise as the dipole.

The dipole's and the ISOTRON's signals were comparable in the receiving mode. In transmitting, at some times the dipole would run about 1 to 2 S units stronger and at other times my signal was about the same. The dipole was at 35 feet and the ISOTRON was at 20. I was impressed!

Performance

The next step was to get the ISOTRON up in the air on the tower. Finally, the forecast was for 50°F, so I decided to run a new line of RG58U coax to the tower. I asked the XYL to come out and hold the ropes while I went to the top of the tower, and in a couple of hours the ISOTRON was up at 57 feet. Now for the big test!

> ***"I can picture them all on one tower with no wires, control cables or antenna rotors."***

Into the shack I went to see if this little thing was really going to do much on the 75 meter SSB portion of the band. I checked again for the resonant frequency and found that the antenna had changed and was now resonant at a much lower frequency, 3.867, with a 1.4 to 1.0 SWR. I use a solid-state rig; I wanted to know what the band width would be as anything above a 2 to 1 SWR causes the output to be reduced. I found that I was at a 2 to 1 SWR at 3.893 on the high side of 3.867, and a 2 to 1 SWR at 3.843 on the low side of 3.867. By using the built-in antenna tuner I was able to cover the whole 80 meter band with no problem.

I am currently using a Kenwood TS-440ST driving a Dentron MLA-1200 amplifier with a Dentron Super Tuner. I was pleased to find that the ISOTRON accepted the 1,200 watts PEP without any problems. (It is rated at 1,000 watts PEP, 500 watts CW, according to the manufacturer.)

I am still stunned at the performance! It exceeded my *wildest* expectations—I was jumping in and out of different QSOs getting signal reports and comparing them to those of the dipole antenna; the ISOTRON was outperforming the dipole, which was mounted at 35 feet! I wondered if it favored a certain direction but found that it is omnidirectional, just as the Bilal Co. .said it would be.

In using the antenna over the past couple of weeks I have found that it has performed above and beyond what I thought would have been possible for such a compact antenna. I think the best report I have received so far was from WØNUJ in Coldsprings, MN, who gave me a report of 59+30, and K9TCC (about 12 miles from me) was running 59+15 with his dipole antenna. I have compared signals many times against the dipole and have found that on stations close in (75-100 miles) at times the dipole was slightly stronger by maybe 1 to 2 S-units. On stations worked over 100 miles the ISOTRON 80 has given me better signal reports.

Some other reviews that I have read of the ISOTRON antennas report that they make great antennas for those who live in restricted areas (apartments, mobile home parks), Field Day sites, or portable sites, and that they are a quick way to get a signal on the air. This is true, but I would like to say that this antenna is not just something to use until you can get a real antenna. This is truly a *real antenna* and I would recommend it for any permanent station.

How does it work?

How do the ISOTRONs work so well? For an antenna to work, it should be electrically resonant. The ISOTRONs are made electrically resonant by using only two components: the large coil in series with the capacitive plates of the antennas. (Match comes automatically with the right combination of the two components at resonance.)

There is more that is necessary for an efficient antenna. An antenna needs a certain amount of area to couple radiation to the atmosphere, sometimes referred to as the "capture area." However, this is an *area*. The area can be any shape or form. The laws of physics for this phenomenon do not specify appearance. The ISOTRONs have this radiation area. They exceed or equal (depending on the model) the area of a conventional half-wave dipole (#12 wire). In simple terms, the Bilal Co. has designed the ISOTRONs into a three-dimensional package. The performance speaks for itself! I'm pulling the dipole antenna down at this QTH and the ISOTRON 80 is going to be *the* antenna. In fact, I'm wondering about the other bands-160, 40, 20, 17, 15, and 10. I can picture them all on one tower with no wires, control cables or antenna rotors.

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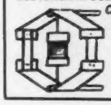

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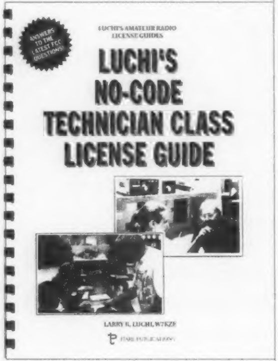
If you want to tune your transmitter without running it at full power, Centaur Electronics offers the Cricket Pulser as a way of limiting wear and tear on your equipment without sacrificing tuning accuracy.

The pulser connects to the rig's CW key jack. Depress the pulse button and adjust the duty cycle for the desired pulse width. For example, if you set the pulse width at 10%, the 1.5 kW amplifier will think you are only running 150 watts, but the full power will be there in pulses, allowing you to use any relative or peak-reading watt meter to tune.

There's also a key-down switch to allow you to run continuous-power tests.

For more information, contact Centaur Electronics at 3720 S. Park Ave, #604, Tucson AZ 85713. Phone: (520) 622-6672. FAX: (520) 622-1341.

No-Code Tech Class License Guide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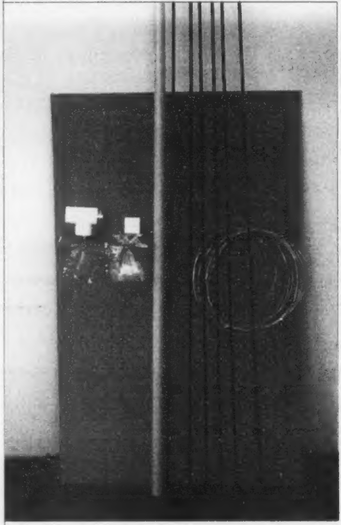
LARRY K. LUCHI W7KZE

Larry Luchi W7KZE has been at it again with this 160-page 1995 edition of his Tech license guide. Latest question pool. Answers. And good explanations so you can take the test understanding what it's all about instead of trying to memorize hundreds of Qs & As. None of this stuff is very difficult to learn, and you'll need to have a good grasp of the fundamentals to go on to your General license. Unless, of course, you are a gutless, wishy-washy, namby-pamby dullard with no ambition to do anything but kerchunk our 2m repeaters, thus settling for about 1 percent of the adventure amateur radio has in store. No offense intended. Tiare Publications, Box. 493, Geneva Lake WI 53147.



Antenna Kits from Cubex

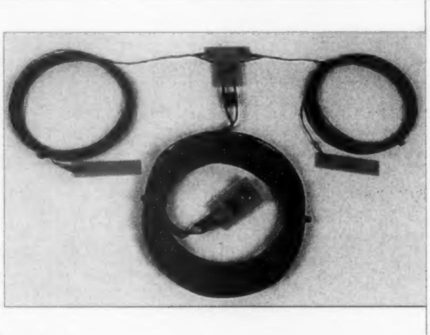
The Cubex Antenna Company has released two new VHF-UHF antenna experimenter kits. The kits contain all the parts needed to build experimental antennas customized for specific applications.

Each kit contains a Fiberglas boom, quarter-inch spreader arms, copper tinned antenna wire, antenna wire notches, insulated feed block, PVC or aluminum boom mast coupler plate and miscellaneous stainless steel hardware.

The kits come in two boom sizes: either 4 feet by 1 inch, or 8 feet by 1.25. The four-foot version costs $29.95 plus $6 shipping, and the eight-foot goes for $69.95 plus $12 shipping and handling.

The address is Cubex, 2716 Sturn St. Unit E, Brea CA 92621. Phone (714) 577-9009. FAX: (714) 577-9124

A New Price On an Old Favorite



MFJ Enterprises has managed to cut the price of the old reliable G5RV antenna to less than $30. The MFJ-1778 is the latest version of this popular wire all-band antenna.

The antenna is just 102 feet in length – less than the length of a full-sized 80-meter dipole. As a sloper or an inverted vee, it's even more compact. With an antenna tuner, you can operate from 80 through 10 meters. With an antenna tuner and a ground, it will even operate on 160 meters.

MFJ's version of this antenna comes fully assembled and ready to handle full legal power for $29.95. The setup includes 102 feet of antenna wire, 32 feet, 6 inches of 450-ohm ladderline terminated with an SO-239 coaxial connector.

The address is: MFJ Enterprises Inc., PO Box 494, Mississippi State MS 39762. Phone: (601) 323-5869.

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Computer-Transceiver Link Announced

JBI Products and Technologies has announced a new computer-radio interface that allows hams to control their radio equipment with a PC compatible computer.

The interface works with units by Kenwood, Yaesu, Icom, Heathkit and Ten-Tec that are designed for computer control.

Johnson Matchbox

Continued from page 28

four narrow plastic spreaders which run the whole length of the coil. They are located every 90° around the circumference of the coil.

The main coil is tapped at approximately 0, 8.8, 12.7, 14.6 and 15.5 turns from each end; the tap at 0 turns means that the entire coil is used. This gives 80 through 10 meter coverage, respectively. 17 and 12 meters are covered but not 30 meters. 30 meter coverage could be provided by an additional tap between the 40 and 20 meter taps.

Link Coil

Wound over the center section of the main coil is an unbalanced input link coil (L2).

The link is wound with the just about same pitch as the center section of the main coil. However, its outside diameter is larger, 3.0 inches. It contains four turns.

The link coil is positioned coaxially with and over the center portion of the main coil. It has an adjustable tap—about 1.25 turns up from ground gives around 50 ohms output impedance. Using all the turns of the link gives in excess of 300 ohms impedance.

Both coils and all the wiring is made from 12-gauge, tinned, solid-copper wire.

Switch

The switch (S1) for selecting coil taps is a rotary unit. It has two poles with five positions (Johnson No. 22.884). It is a successively shorting design, although I'm not sure if this is strictly necessary. The switch is not large—it's about 1.75 inches in diameter. The two switch sections are located on opposite sides of 3/16-inch thick ceramic insulation. In my home-brew version, I just used alligator clips to tap the coil.

Capacitors

There are two variable capacitors. They are both rated at 3 kV peak using 0.075 inch plate spacing and ceramic insulation.

The first one (C1) is an ordinary dual gang unit, with 10 to 100 pF of capacitance per section (Johnson Part No. 154-505-4 [100ED30]).

The other capacitor (C2) is set up as a two gang, dual differential variable, also 10 to 100 pF per section (Johnson Part No.169-25 (100EDA30)). Adjusting a dual differential capacitor causes one section to increase in capacitance while the other section decreases. For example, as the capacitance of section C2a is increased, that of section C2b will decrease (ditto for sections C2d and C2c, respectively). For this circuit, the rotor of this capacitor needs to be insulated from the chassis.

My home-brew version of the Matchbox was built on a metal plate resting on a wooden chassis. The manufactured version comes in a 10 x 10 x 8-inch high metal box.

Tuning Up

Tune up is simple. Install an SWR bridge between the transmitter and the matchbox with short pieces of coaxial cable. Select the correct coil tap for the band to be used. Using the lowest possible power input to get an SWR indication, juggle both variable capacitors for the lowest SWR. There is interaction between the capacitor adjustments.

Or, to be more considerate of others on the air, connect an antenna noise bridge to a receiver. Set the noise bridge to 50 ohms resistive, then adjust the tuner for a dip in noise in the receiver.

Performance

Using my particular antenna (a 275-foot long closed loop, roughly triangular in shape, approximately parallel to and about 25 feet above the earth, fed with 25 feet of home made 600 ohm open-wire line), I'm able to achieve very nearly a 1:1 SWR on all bands. Current balance, as indicated by an RF ammeter in each leg of feed line to the tuner, is excellent though my loop is not symmetrical. The Matchbox circuit provides at least 15 dB of harmonic attenuation as it is a resonance circuit. It gives some preselection for the receiver as well. You'll realize this when you have to retune every several hundred kHz or so on 80 and 40 meters if you want to keep the SWR low. I don't find this a serious inconvenience, since I made up a calibration chart giving frequency vs. dial setting.

Continued on page 59

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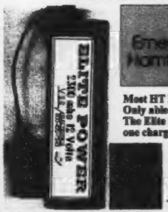

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RTTY LOOP

Amateur Radio Teletype

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The accumulated showers of e-mail and letters this month are threatening to make a messy desk messier, if that is possible. So, let's look at what some of you have had to say.

Evaristo F. Nievera N2MBC enjoyed the review of ham radio Internet sites in the October RTTY Loop, and writes that he is just learning the ropes of the Internet, and had looked everywhere for amateur radio sites or home pages, only to find the information here in RTTY Loop. Formerly DU1EN, Rickey received his U.S. call five years ago and continues to stay in touch with Philippine news through the Internet. He has tried several of the commercial services, including CompuServe, Prodigy, and America Online, but prefers a direct connection through an Internet Service Provider for economy and speed of transmission.

He adds that since we are in the bottom of the sunspot cycle, with propagation at a long-time low, the Internet presents a threat to amateur radio. His current activities include packet and PACTOR, and he is looking into color transmission with PACTOR.

Well, Rickey, while I share your concerns about computer communication affecting amateur radio, perhaps the death knell is a bit premature. After all, the same could have been said of the telephone, other broadcast media, or even, as once was forecast, the citizen's band. But we're all still here. With new frontiers to conquer, and new techniques to explore, I think ham radio will lead us into the next millennium.

Then there was all the input on the question of sound boards and digital modes. Johan Forrer KC7WW fills us in on the origin of a term questioned in a previous column. "PSA" stands for "Personal Sound Architecture" and was coined by Analog Devices for a three-chip set: an ISA bus interface chip, a 16-bit stereo CODEC (the ubiquitous AD1848), and a ADSP-21xx family DSP chip. Several sound board manufacturers have used these on their sound boards. Unfortunately, this technology has already been made obsolete by the introduction of newer versions of the chipset. Echo Speech Corp, for example, now has the latest ADSP-2181 and a new ISA interface that offers WIN95 plug and play hardware and software.

Meanwhile, Rob Glassey G0VTQ (Robert.Glassey@nmp.nokia.com) writes the following: "I've been corresponding with Erwin Cremers about DSP software using a Soundblaster™ card and he mentioned you as someone who may be working on this kind of software. I'm interested in corresponding with anyone working in this field, since I am writing Soundblaster DSP programs too. My current project is a Soundblaster-based Ham Radio HF data modem. So far I have written code to demodulate RTTY to the screen, with tuning and input level indicators. This works, but is still in the very early stages. My ultimate aim is to TX/RX RTTY, AMTOR, PACTOR and possibly PACTOR II, both FEC and ARQ modes. I'd also like to try out some highly robust modes such as the second generation of CCW/BPSK for extremely low SNR comms (portable QRP DX)."

While I am not working on such a project, I am reasonably sure that at least one of the readers of this column (other than you) is., so I look forward to the establishment of a match, and feedback of any progress. Good luck.

One of the wonders of amateur radio is the international nature of the hobby. A site for "serious DXers" can be found at: http://promet12.cineca.it/htdx/— Mirko Caserta, IK0ZSN, is the "Awards Page" manager. These pages contain the latest information about Italian Ham Awards, along with plenty of details about satellites, DX news, contests, and the like. This is both an attractive and useful page. Check it out.

Mark Walker N9HCI wrote that he was troubled with the version of Hamcomm he was using. "Got a copy off the net, looks really neat, except the tones do not go high enough to be usable. 2000 Hz is the top end for the generated tones. Any ideas? My only other choice is an old TU I have which generates RS232 on RECV OK, but would require some means to modulate the 120mA loop with the ±12v from the serial port's TXD line. Any sources you may recommend would be appreciated. Mark."

I dropped Mark a note telling him that the actual tones should not matter... just the difference between them. Not knowing which version of Hamcomm he had, I sent him version 2.2, which is on disk #5 of the RTTY Loop Software Collection, to try out.

His response: "The new Hamcomm works great." The moral? If a version of the software you are trying does not seem to work, look around for a new version.

An unsolved problem comes from Dave N3AAT, who notes that he has a Delta 2/Level Controller and Macintosh Portable. He wants to know what he has to do to get onto RTTY, whether he needs a controller, or if there is a software solution.

On a related note, Bob Castaneda KC7QR asks: "Maybe you can point me in the proper direction? I'm looking for a "good" RTTY program for this Macintosh Centris-650 computer that I'm now using. And maybe (but down the line) an SSTV program that will work on this too. I've been a ham since about 1972 and for most of that time it's been on RTTY. Have worked WAS, WAC, DXCC-RTTY, and some other stuff, most of it on the "old" model 15s and 19s. Found an excellent program for the Apple IIe computer for RTTY but don't have much room here in this small shack for more than one computer, so would like to find an RTTY program for the Mac. But if I can't find one, I guess I'll just have to hook up the old IIe again, huh? Hi."

Well, guys, unfortunately, I have very little Mac software. I know there is quite a bit out there, though. You might check on AOL, in the Ham SIG library, or on CompuServe, in HamNet. By now, I shouldn't have to hint to share the findings with us over here, should I?

Ray Ortgiesen WF1B advises: "I think folks interested in the RTTY loop page may want to surf (oh I hate that word) over to my page. It's got some assorted RTTY stuff on it. http://ids.net/~wf1b/home.html is Ray's site. Check it out, you may well enjoy it."

Speaking of Web sites, there is the home page of RTTY Loop at http://www2.ari.net/ajr/rtty/. One of the more popular features of the page is the library of old columns. Bill Howell N5ALO asks if it would be possible to have access to earlier issues? "If these are just sitting around on disk somewhere, wouldn't it be easy to plug them into the Web page?" Yes, Bill, it would be easy, but space consuming, and I have a limited amount of space on my server. I am trying to put up columns, downloads, and information useful to the readers of the column. Feel free to drop me a line, via e-mail or snailmail, if you have any suggestions.

Luis XE2MXU/N5UHB passes along his congratulations on the new web page. "It's good to see that at least one of the columns of *73* is on the web now. Now if we could get the rest of the magazine in there..:)" I can't speak for the rest of the magazine, Luis, but I look forward to sharing with all of you this way for a long time to come.

We've covered the past and future this month, along with plenty of your input. I always look forward to your cards, letters, and e-mail. Reach me via snailmail at the post office box above, or via e-mail at ajr@ari.net, MarcWA3AJR on America Online, or 75036,2501 on CompuServe. More next month, with plans to highlight some recent RTTY and related equipment.

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HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors Inc.
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Technology and no life

I recently read a terrific article written by one of my favorite writers: Unknown. I chuckled so long and hard over the truisms that I decided to share them in my "Hams With Class" column. I'm sure that teachers and instructors of amateur radio who read my column will find appropriate use for this "ice-breaker."

You know technology has taken over your life when:

1. You have never sat through an entire movie without at least one device on your body beeping or buzzing.

2. Your stationery is more cluttered than Warren Beatty's address book. The letterhead lists a fax number, e-mail addresses for two on-line services, and your Internet address, which spreads across the width of the letterhead and continues to the back. In essence, you have conceded that the first page of anything you write *is* letterhead.

3. You need to fill out a form that must be typewritten, but you can't because there isn't one typewriter in your house....only computers with laser printers.

4. You think of the gadgets in your office as "friends," but you forget to send your mother a birthday card.

5. You disdain people who use low baud rates.

6. You use the phrase "digital compression" in a conversation without thinking how strange your mouth feels when you say it.

7. When you go into a computer store, you eavesdrop on a salesperson talking with customers....and you butt in to correct him and spend the next 20 minutes answering the customers' questions, while the salesperson stands by silently, nodding his head.

8. You know Bill Gates' e-mail address, but you have to look up your own Social Security number.

9. You sign Christmas cards by putting :-) next to your signature.

10. Off the top of your head, you can think of 19 keystroke symbols that are far more clever than :-)

11. You back up your data every day.

12. You think jokes about being unable to program a VCR are stupid.

13. On vacation, you are reading a computer manual and turning the pages faster than everyone else who is reading John Grisham novels.

14. The thought that a CD could refer to finance or to music rarely enters your mind.

15. You go to computer trade shows and map out your path of the exhibit hall in advance. But you cannot give someone directions to your own house without looking up the street names.

16. You would rather get more dots per inch than miles per gallon.

17. Al Gore strikes you as an "intriguing" fellow.

18. You own a set of itty-bitty screwdrivers, and you actually know where they are.

19. While contemporaries swap stories about their recent hernia surgeries, you compare mouse-induced index finger strain with a 9 year old.

20. You are so knowledgeable about technology that you feel secure enough to say "I don't know" when someone asks you a technology question, instead of feeling compelled to make something up.

21. You rotate your screen savers more frequently than your automobile tires.

22. You have a functioning home copier machine, but every toaster you own turns bread into charcoal.

23. You have ended friendships because of irreconcilably different opinions about which is better—the track ball or the track *pad*.

24. You e-mail this message to your friends over the net. You'd never get around to showing it to them in person, or reading it to them over the phone. In fact, you have probably never met most of these people face-to-face.

25. You understand all the jokes in this message. If so, my friend, technology has taken over your life. I suggest, that for your own good, you go lie under a tree and write a haiku. And don't use a laptop. 73

Photo A. *When working with students, try to keep them "balanced" so that technology doesn't take over their lives.*

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Foxhunting the European way

According to a documentary I saw on "The Learning Channel," the urge to find hidden objects dates back to early civilizations. The children's game of hide-and-seek was played in ancient cities. So perhaps we hams are following a primitive instinct when we set out on hidden-transmitter hunts. Or maybe we are just satisfying our natural urge to compete.

Modern-day T-hunts, as they are called in the USA, usually involve a car full of radio direction finding (RDF) equipment and hours of driving, depending on the hunt rules. Over the years, vehicular T-hunting has gained popularity in England, Australia, and Japan. Elsewhere in Europe and eastern Asia, amateur RDF contesting (ARDF) is just as popular, but nobody uses a vehicle.

While our mobile T-hunts frequently require RDF on foot (called "sniffing") to track down a T that may be a few dozen yards from the road, it's usually a "sniff" from beginning to end in other countries. The international on-foot style of ARDF goes by such names as foxhunting, fox-teering, and fox-tailing. Though it is a sport for all ages, many cities in eastern Europe and Asia include foxhunting as part of Physical Education in schools.

Rules and preferences vary from country to country, but in most cases three to seven transmitters (foxes) are placed in a rural area of 200 to 2,000 acres. They transmit for a minute each, in numbered sequence. CW on 80 meters and AM on 2 meters are the most popular signals to hunt. Runners with direction finding equipment attempt to find all foxes, or as many as they can, then reach the finish line in the shortest possible time. Scores are determined first by number of foxes found and second by elapsed time. Sometimes bright orange and white orienteering flags (called prisms) are placed near the foxes to insure that they are visible. Other groups think prisms are for sissies and allow foxes to be concealed or even buried.

Detailed topographical maps are provided to all competitors to aid them in navigation and bearing-plotting. The sport is so popular in so many countries that regional, national, and international championships are held regularly. To this end, a standard set of rules has been developed by a committee of the International Amateur Radio Union (IARU) to specify the number of foxes, course size, age/sex divisions, fox timing, and the use of prisms.

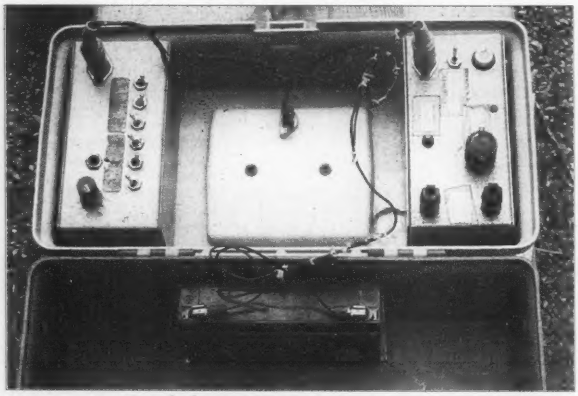

Photo A. This Swedish 80 meter fox transmitter is built into a small toolbox. The timer is designed to be synchronized with six other foxes and can be set several hours in advance. The empty space is useful for storing the antenna wires.

Bavarian beacons beckon

Ewald Stadler DJ2UE of Herrenberg is a very active promoter of ARDF. As a foxhunt organizer for the Deutscher Amateur Radio Club (a national organization in Germany that is similar to our ARRL), he is responsible for competitions of all the local clubs in his district. DARC has an entire subdivision for ARDF; its annual foxhunt calendar includes over 60 formal events.

"In Western Europe we do foxhunting as a club activity," Ewald told me. "It is for all ages. We have between 20 and 70 people coming to each competition. Most of them are over age 30. We also do mobile hunting, but that is in a different division. We don't like the mobilers because they make too much dirt in the air. Vehicle hunts are declining because of problems like road congestion."

DJ2UE continues, "At our contests we always hunt 80 meters in the morning and 2 meters in the afternoon, except for our championships when we have them on two separate days. On 80 meters, you have to know your equipment, the null and front-to-back ratio. But mostly it's running, a sport competition. However on 2 meters, it's a brain competition. You have to be very careful what you do because of the signal reflections. On 80 meters you can stand still and navigate and take your bearing and then go, but on 2 meters, no way! If you stand still and take a bearing, you may be off by 30 degrees."

Vertically polarized longwire fox antennas are the rule on 80 meters, but it's different on 2 meters. According to Ewald, "For VHF foxhunting in the forest, you can't use vertical polarization. The trees are all reflectors, and if you hide it well with vertical, you'll never find it. So we use horizontal polarization. For a four-mile course, it usually takes me an hour to find all foxes. Some hunters take two or three hours depending on how difficult it is. When I hide, I usually make it easy and I don't use very hilly country.

"A problem with foxhunting in Germany is that if you have a large group, say 70 people, they tend to follow one other and it's not a true competition. To solve this we sometimes scatter dozens of little 100 milliwatt 80 meter transmitters in the grass, each with an aerial of about 1 foot length. They transmit only a few feet, so you can find them only when you are close. I draw circles on the map where these transmitters are hidden. Hunters use the map to run to these circles and once inside them they navigate for the fox."

Swedes do it in the woods

There is more foxhunting activity to be found in Sweden than in any other country in Scandinavia. The last IARU World ARDF Championships were held there in 1994. My wife April and I had the pleasure of visiting this beautiful country last summer, where we were welcomed by Per-Axel Nordwaeger SM0BGU and Lars Nordgren SM0OY. Per-Axel, who was the main organizer of the 1994 Championships, took us to a typical forest near Stockholm, where he showed how their weekly foxhunts are done.

P-A, as his friends call him, explained the history of hidden transmitter hunts in his country. "In the 1960s we had something called a triple hunt with two or three people in the car; one to drive, one to read the map, and a third to do the receivers. Today gasoline is about a dollar a liter, so we always do ARDF by running."

NO TRESPASSING signs are the bane of transmitter hiders in the USA. Not so in Sweden, where there is a principle of law called *Allemansratten* (Everyman's Right). It allows every person to move about freely on foot in forests and fields, without worrying about property lines. They can swim, sail, and motorboat on lakes or rivers, and even make camp with a campfire for a night without permission from the landowner. Allemansratten provides Swedish foxhunters with their choice of hundreds of forest locations for ARDF contests, so long as they take care to pick up litter and protect the vegetation.

Swedish forests are a paradise for orienteering enthusiasts because they are hilly with extremely thick vegetation. Often you can't see more than a few feet in any direction. They are full of lakes and swamps. Much of the ground is covered with small stones. It's hard enough to imagine finding your way in terrain like this in the daytime, but the intrepid Stockholm area foxhunters do it at night! Seven foxes start transmitting at 7:10 p.m. each Wednesday from May to late September. During spring and fall, this is after sunset. P-A says he wears a helmet with a 30 watt halogen headlight on it to help find his way during night hunts.

> **"What a wonderful way to let children and teenagers know that computers aren't the only way to have fun with electronics."**

"We also come together on a Sunday morning for what we call a national competition," says SM0BGU. "That means that one club organizes a hunt to which other clubs are invited. We use no prisms. Foxes are concealed under leaves or branches. In Gothenberg, they dig down into the ground and bury them. It takes about five hours to put out all seven foxes before a hunt.

"We are not allowed to run in the forest with short pants and shirts," P-A continues. "That is due to an epidemic about 15 years ago of hepatitis, or something similar. Nobody could figure out why only orienteers got the disease. Then they noticed that many competitors ran through the same paths in the forest and got scratches from bushes. Doctors suspected that blood was getting on the branches and being transferred from one runner to another. We changed the clothing requirement and it totally solved the problem.

"During previous World Championships, youngsters from Korea and Japan ran with nearly no clothing at all, even though it was cold with snow. So when we sent out information on our 1994 competition, we included a picture of a runner dressed the proper way so they would understand that someone not fully clothed would not be allowed to run. No one came dressed improperly."

Follow the bouncing signal

Almost all Stockholm area hunts are on 80 meters. P-A dislikes the signal reflections that plague VHF hunts. "I don't find 2 meters very interesting because it's so unpredictable," he says. "You end up in many places other than where the transmitter really is."

Simple Swedish 80 meter foxes (see Photo A) use inexpensive color TV subcarrier crystals, putting them on 3580 kHz. A rope thrown over a tree hoists the longwire antenna with one or two ground planes underneath.

P-A says skywave propagation causes problems during nighttime hunts. "Strong Italian signals sometimes cover our fox signals at the start point. We have to run into the forest and hope we hear them." According to SM0BGU, most hunters use the same receiver design, which is about the size of a cigarette pack (see Photo B). "Two Swedish radio amateurs started building them around 1965," he says. "It has been developed over the years. We can buy them either complete or in parts. The ferrite loop is quite OK. Lars uses a larger loop instead. It is heavier to carry, but gets a sharper bearing null.

"The old-fashioned receivers interfered with each other, so we had to spread the hunters out. Our hunters scatter into the forest two minutes before the first fox comes on. They are allowed to continue to search for two minutes after the last transmitter shuts off. About an hour after the hunt ends, the foxes automatically start transmitting again to help the organizer find them to pick them up."

Each fox has a crystal-controlled timer that P-A says is easy to synchronize. "Using switches, I can choose how many hours and minutes prior to start I will begin the timing. When I have exactly the selected number of hours to go, I run the cable into each fox and push the start button. It starts all the transmitters to count down to zero and then count forward. The display shows actual foxhunt run time. We trust hunters to write down the correct time on their card when they find a fox."

A toolbox-sized container with wires and timer display might look suspicious to a non-ham in the woods. "We had a competition outside Stockholm not far from the new royal castle," SM0BGU recalls. "On that island is the most secret radio installation in Sweden. This competition was very close to that area. We stopped hearing one of the transmitters and went to investigate. It was on a peninsula in a very swampy area between the mainland and the island. Normally nobody would go out there except silly foxhunters, but two young girls came out in a canoe and happened to find it. They didn't know what it was, so they rolled up the antennas and took it home to daddy.

"I had to go to the police to report the theft because it was close to the military installation. In the meantime, the organizer put flyers on lampposts around the area. One happened to be in front of the house where the girls lived. The homeowner saw it and we got it back, but it took a week. Now we put signs on the foxes."

The world awaits us

International-style foxhunting sounds like a great sport, doesn't it? What a wonderful way to let children and teenagers know that computers aren't the only way to have fun with electronics. Since publication of my "Homing In" columns about Hamcon/Foxhunt-95 in Southern California last fall, I have heard from hams who are planning to hold on-foot RDF contests like this in such diverse places as Pittsburgh PA, Daytona Beach FL, Portland OR, and Victoria BC. What about your town?

Organizers of European and Asian ARDF competitions are eager to have entrants from North America. To that end, they have established a special Promoters section in each championship, for countries such as the USA that have never participated in any international ARDF event. Each first-time IARU society may send a maximum of six competitors for the Promoters section, which will have its own special awards.

***Photo B.** Per-Axel Nordwaeger SM0BGU demonstrates how foxhunters get bearings on 80-meter signals in Swedish forests.*

The 1996 IARU Region 3 Championships will be held in Townsville, North Queensland, Australia from July 15 to 20. The 1996 European Championships will be September 1 to 6 in Bulgaria, 45 miles south of Sofia in the Rila Mountains. The next IARU World ARDF Championships will be in 1997, probably in Germany or China. If you would like to attend any of these events and can finance your own transportation to the host country, contact me for information on how to register.

If you're going on a foxhunt in a foreign country, it wouldn't hurt to listen to some language instruction tapes before you go. April and I were pleased to discover that the majority of Swedes know conversational English. However, there are exceptions. SM0BGU tells this story from the 1994 championships: "One of the competitors got lost and ran all the way through the 2 meter area into the 80 meter area. When he realized the problem, he found the main road and stopped a car. He only knew one Swedish word, which meant 'engineers' for the engineering regiment where the competition was headquartered. Unfortunately, he pronounced it wrong and it sounded like another Swedish word that means 'nothing.' The driver couldn't understand him, so he took him to a police station. Fortunately, the police knew what we were up to, so they called the regiment and we sent a car to pick him up."

Keep your cards, letters, and e-mail coming. "Homing In" readers want to know what's new in RDF contesting in your area. Write to the address atop this article or send e-mail to me at Homingin@aol.com or 75236.2165@compuserve.com.

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The end of monitors

For the past couple of months, we've been exploring the repair of dead computer monitors. Let's see if we can finish that up, so next time we can get into something else.

Set 'em up

With any luck, the past few months' columns have helped you to get that dead monitor running. If it's a few years old, though, you may be less than satisfied with the picture. Oh, sure, it was exhilarating to see it finally work at all, but now you want it to work *right*. Setting up a color display isn't hard, but it seems to be a dying art, and is probably one of the least understood procedures these days. I've even met some TV servicers who weren't clear on how to do it.

The elements

The basic elements you have to adjust are image size, geometry, brightness, black level, color balance, color tracking and focus. Wow, that sounds like a lot, doesn't it? Really, it doesn't take long, because some of the adjustments help set some of the others. Let's dive in!

Before we start, I must repeat my previous warning: The insides of TV sets are mighty dangerous! When you're poking your screwdriver inside to get at a control, it is remarkably easy for your hand to touch something. If that something happens to have plenty of voltage on it, you're in trouble. To help avoid disaster, remove your wristwatch and jewelry. If you have any rubber gloves, wearing them can really help. Just be sure to keep your eye on the part of your hand that *isn't* near what you're aiming for, as well as what is. And, of course, wear shoes; the less grounded you are, the safer you are. The old TV shop maxim of putting one hand behind you is still good advice, too, because it prevents your getting shocked across your chest, which is the most dangerous path in your body.

Now that I've terrified you, let's get started. Hook the monitor to your computer and set it up for an average picture. On a *DOS* machine, that would be text; in *Windows*, perhaps the program manager area. On a Mac, the normal desktop is best.

The very first adjustment you need to set is the image size. Unlike on normal TV sets, computer monitors deliberately leave some black area around the edges of the picture, because things can get too fuzzy if the scan goes all the way to the edge of the tube. Typically, 1/4" to 1/2" will be left black. If your monitor looks otherwise, snoop around the PC board until you find the vertical size control. Adjust it until the picture fills all but that desired black border, from top to bottom. If the black areas at the top and bottom are not equal, find the vertical centering control and get the image centered. To set the width, look on the board, in the area of the flyback. Now and then you might find a trimpot for width, but most width controls are coils with ferrite slugs. The coil may not be labeled, but it will probably be the only one in that area of the circuit. Try adjusting it carefully to see if the width changes. (Be sure to use a plastic coil tool, not a screwdriver; if you crack the core, you have a problem on your hands.) Set the width for about the same black areas on the picture's sides that you have on the top and bottom.

If the image is off-center, the obvious solution would seem to be to adjust the horizontal centering control. Most sets do have one, although sometimes it's a jumper wire and three pins you can plug it into, rather than a pot. Before you change any of that, though, look for a trimpot labeled "horizontal phase," or sometimes just "phase." Try that one first, as it will have a bigger effect. Usually, the centering control will be set correctly when it's fairly close to the center of its range.

If the picture looks pretty square, you don't need to mess with the geometry. If the sides bow in or out a great deal, though, look for a control labeled "pin" or "pincushion." Adjusting it will have an obvious effect. You may also find one called "trapezoid," the setting of which will also be pretty obvious. Geometry controls are always a compromise; don't expect to ever get a perfectly square scan on the curved surface of a CRT.

Lookin' good!

Now that your picture is the right size and shape, it's time to set something called the "screen." This is an overall bias adjustment that sets the amount of current which will pass through the CRT, from the electron gun to the phosphor screen, and it affects all three colors (red, green and blue) at the same time. Its primary effect is to fix the black level of your picture; set it too high and your blacks will be gray, too low and your bright areas will be weak and dingy. You'll find the control on the side of the flyback transformer, usually right near the focus control. Be sure to use an *insulated* screwdriver, as the voltages around the flyback are in the thousands. To set the screen control correctly, turn the brightness and contrast all the way down. Now, get a flashlight, and turn the room lights off. Use the flashlight to get your screwdriver in position. Observe the picture, and turn the screen control until you can just see a very dim image. If it looks discolored, don't worry about that just now.

Next, turn the brightness and contrast up to a bit higher than normal viewing levels. Adjust the focus control for best focus at the center of the image, while keeping an eye on the corners of the screen. Small changes in the focus setting will have much more effect at the picture's edges than in the middle, and sometimes you have to compromise a little bit in order to get uniform focus. If the edges won't come into sharp focus no matter what you do, you have to accept that it's the best the monitor can do. Age and condition of the CRT can greatly affect edge focus, and some monitors don't focus well at the edges even when they're brand new. Do the best you can. Generally, PCs demand less of their monitors' focus than do Macs, which present considerably more information on the screen. I've fixed many monitors that looked great on my 386 but awful on my Mac.

Black and white in color

Believe it or not, the best test of a color monitor is how well it can make black and white! Let the monitor warm up for at least 15 minutes, and then set your computer for a black and white image on the screen. If the gray areas look gray, with little or no coloration, you're all done. I'm not talking about fringes of color around objects—that indicates misconvergence, some of which is normal in all color monitors. I'm talking about entire areas, or perhaps even the whole picture, having undesired color. To be sure everything's set right, try turning the brightness down to about 1/3 normal. If the picture turns a different color, you need to set up the color balance and tracking. I make it a matter of course to do that on any hamfest monitor I fix.

This set of adjustments can take awhile, but it isn't hard. Set the black and white picture to low brightness (but not way, way down to where you can barely see it), and find the color controls on the back of the set. Often, they'll be on a PC board attached directly to the back of the CRT. Sometimes, though, the board is mounted behind the tube.

You should have six controls: three for screen (not the same thing as the screen control on the flyback), and three for drive. There are three of each, of course, because each of the three guns (red, green and blue) needs its own set. Sometimes, the screen controls will be labeled "bias," and/or the drive controls will be labeled "highlight," or something similar. It should be apparent which are which, anyway. If you only find two of each, that means one color, usually green, has its values fixed, and you must adjust the other two relative to it. If you find a total of three, chances are your monitor has only drive controls, with fixed screen values. It is easier to adjust such sets,

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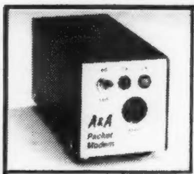

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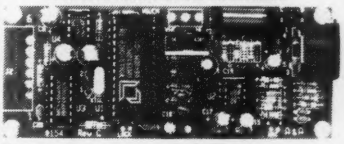

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because you aren't setting the screen controls, but they don't produce color as accurate as monitors with all the controls. I've only seen that configuration once or twice.

The screen controls set the amount of each color you will get in low-brightness areas of the picture. You must adjust them first, because they affect the brighter areas too, at least to some degree. Since your monitor was at one time in good alignment, don't try messing with all three controls; just adjust the one that seems prominent. If you have too much red, for instance, turn the red screen control down until it goes away. If it's already all the way down, you will have to turn the others up to balance with the amount of red. Your goal is a uniformly gray picture.

Once you get it, turn the brightness up to normal and adjust the drive controls for good white in the picture's highlights. Do it the same way, turning only the one that's prominent, and then touching everything up for least coloration. Theoretically, you're all finished. In practice, though, you will find you have to go back and do the procedure several times, because the two sets of controls interact. No matter how hard you try, though, you may find it's impossible to get it exactly right. As long as the picture looks good at normal brightness levels, don't worry about it. But, if you can't get it even close, your CRT may be weak. Sometimes you can get a TV shop to "rejuvenate" a CRT, using a special device, but it doesn't always make too much difference, and, now and then, it can destroy the tube.

Once you've done all this, go back and touch up the focus control. Now, set your computer for a color picture and stand back—you should have a gorgeous image.

And that's the story of, that's the glory of, setting up a color monitor! I'm typing this article on a 14" SVGA monitor hooked to my Mac. I got the set for $5 (it was dead, of course), and it looks as good as any I've ever seen in a store, and better than a lot of them. This stuff really works.

Until next time, 73 from KB1UM. 73

Three-Element Direct Connect Beam for 2m

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Edward Oros AC3L
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If the concept of my direct connect antenna ("1, 2, 4 — A Geometric Progression That You'll Love" from the September 1995 issue of *Radio Fun*) caught your attention, you might also be interested in a three-element version of the antenna. (The "Tiny 2" utilizes two elements: the driven element is 1 foot, 7 inches for each side, and the director is 2 feet, 9-1/4 inches.)

As with any standard three-element design, this three-element direct connect antenna utilizes a reflector and a director to achieve gain. As in the case of the "Tiny 2" the front-to-back was sacrificed in order to squeeze as much gain as possible for the antenna. I managed to obtain 6.52 dB over a dipole in free space while still retaining a direct connect antenna.

Right up front you might ask, "Why build this antenna rather than some other design?" The first reason is the very fact that it *is* a direct connect antenna. The design allows you to hook your cable directly to the antenna without the time-consuming process of matching, yet the SWR is just 1.18 to 1. The 6-1/2 dB gain is, of course, a nice bonus. Another appealing feature of this design is the element diameter. Each of the elements is made from 1-inch diameter aluminum tubing. I like the fact that you don't have to play around sliding elements in and out trying to get to the proper lengths. You simply cut each to the lengths shown in Fig. 1 and position the elements on the boom. It is also easy to find 1-inch furniture tips at local hardware stores (they give the antenna a slick professional look).

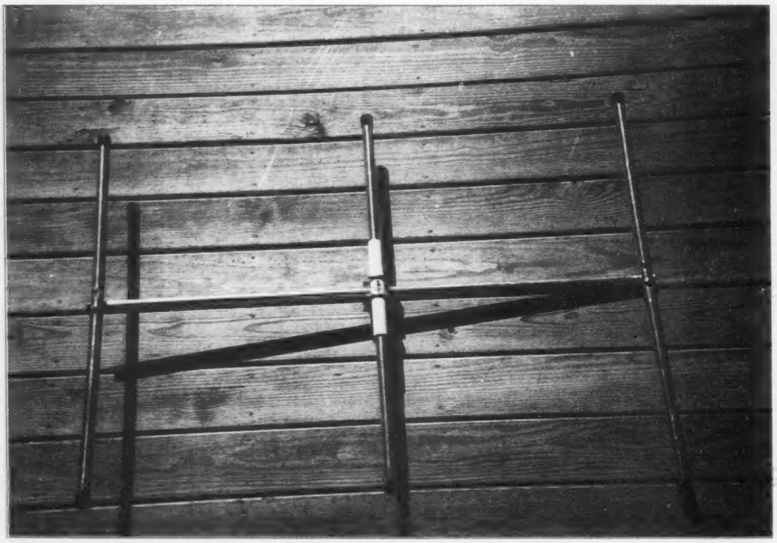

***Photo A.** It should look like this when you're done.*

"Quick, slick — a good pick for first-timers!"

Construction Notes and Hints

You will need a boom length of about 4' 2" even though the distance between the reflector and the director is only 4 feet. The extra space is needed to allow for the use of mounting brackets to hold each element to the boom. As far as connecting the elements goes, any of the popular mounting techniques can be used to attach the elements; you can even use the double bracket clamp method from the "Tiny 2" design if you wish. Center each of the elements by using the center point column illustrated in the sidebar. When mounting the driven element, remember that it is split at the center and must be insulated from the boom; you can use PVC pipe to accomplish this. It helps to insulate the elements, and supports them at the same time.

To Build or Not To Build

There are so many antenna designs out there that it may be difficult to decide which one is worth your effort. The simplicity of this three-element direct connect antenna makes it perfect for clubs and organizations looking for a "first time" antenna project. The proper location for connecting the

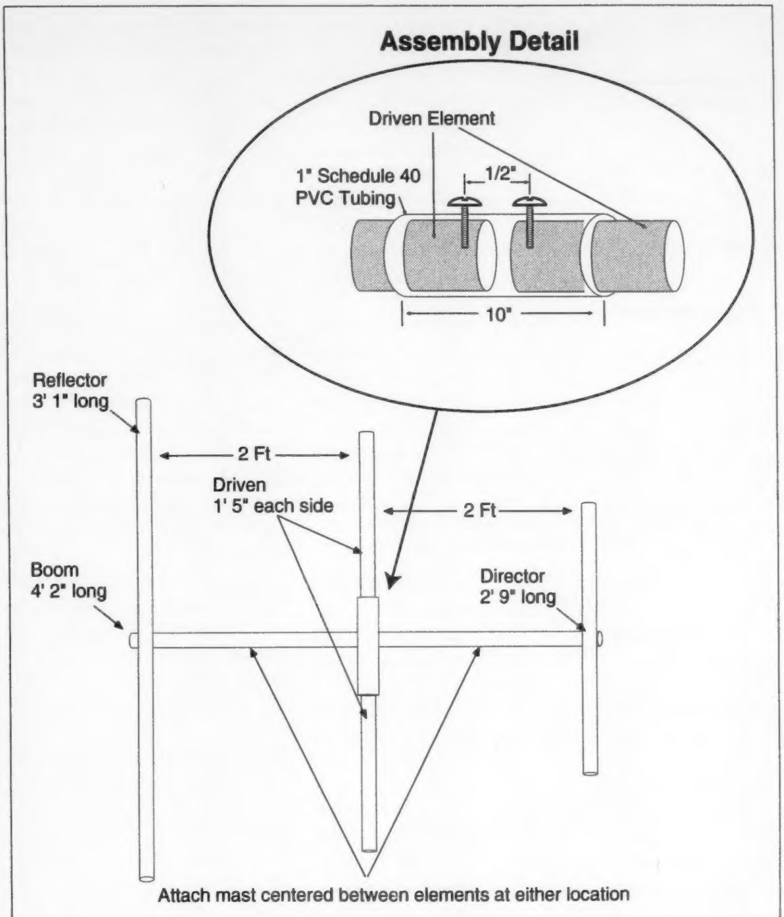

Fig. 1. Construction details.

mast is exactly center, either between the driven element and the director, or between the driven element and the reflector. Connecting a metallic mast any closer to the elements will detune the antenna causing a higher SWR. 73

NEVER SAY DIE

Continued from page 39

will expect to see you there with your entrepreneurial antenna raised. If you come across any newspaper articles you think I ought to know about, clip 'em and share them. Don't worry that someone else may have sent it too. I'd rather have five than none. I want to know what is going on in almost any new technology. I want to know about any really good ideas for helping to solve our social problems. And our health, education, and so on.

But you should be learning all you can about these things too. Long after you've forgotten a "Roseanne" episode or a ball game, your new knowledge will be with you.

My apologies. I'm probably boring you. I'm stupidly trying to change human nature. The optimist in me keeps making me forget how resistant almost everyone is to change. That's the reason I stopped doing Dianetic therapy back in 1951. I read about it in the book when it came out. It made sense, so I tried it. It worked beyond my highest expectations, so I quit my job, went to the Dianetic Research Foundation and got to be really good at it. And I cleaned out all of

Continued on page 63

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HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108

In the December 1995 "Ham To Ham" column I wrote about using an IR detector diode across the mike input of a high gain audio amplifier in order to test the remote's operation — at least to determine if it's outputting pulses. Klaus Wolter N8NXF of Ann Arbor MI notes that another way to "view" IR LEDs is via a CCD television camera. Apparently, some CCD cameras have enough response in the infrared region to "see" these remotes pulsing when aimed at the camera's lens. Vidicon cameras probably won't. On the other hand, F.A. Bartlett W6OWP, and Erich Kern wrote in saying that all you really need to do is to hold the IR remote next to the tuning section of any AM broadcast receiver to "hear" the pulses. They're right, because these hand-held IR remotes put out a fair amount of digital pollution, they'll come over an AM receiver very nicely, proving that there is indeed room for too much engineering sometimes! For testing the operation of IR headphones and microphones, the IR detector/audio amp idea that I proposed is still perhaps the best way, but there are always other alternatives...which brings me to the purpose of this column; to provide a forum for your ideas, even if they may be "different." A good initial response has been received, but I still need many more tips, ideas, suggestions and better ways of doing things from all *73* readers. Don't worry about your writing skills, just include as much detail as you can and I'll put it together in the style of the column. Let's hear from you!

This month we begin a series of tips offered by Richard Measures AG6K, of Somis CA. Rich has done a tremendous amount of research into VHF parasitic oscillation suppression in amateur HF linear amplifiers, as well as fathering many practical servicing tips for some of the current amateur transceivers and accessories. With Rich's permission, I've condensed some of his best suggestions into the column's format, and over the coming months I'll include one of his tips in each column...be sure to watch for them.

One inoperative meter cure

From Richard Measures AG6K: An inoperative meter may not necessarily be bad, just in need of an overhaul. With time, humidity and the natural corrosive effects of the atmosphere, the meter used in the Heath SB-220 linear amplifier can appear to be unusable. But as in other areas of life, appearances can often be deceptive. The meter Heath used in the SB-220 is not unlike the meters used in many other pieces of ham gear, so the techniques I'll explain here aren't just for SB-220 owners by any means. Here's the reason: many meters are assembled using different types of metals for the various meter parts. These parts, which are then expected to conduct current to the meter's armature, are fastened together using machine screws at the joining points that act as the electrical conductors within the meter. As previously mentioned, time, and the effects of humidity and air pollutants, can result in electrolysis occurring at the junctions of these dissimilar metals — a perfectly natural phenomenon — but definitely not desirable within our meters! The increased resistance at these junctions can cause an intermittent or open connection at various points between its rear terminal and the meter's movement.

The problem can often be solved simply by prying off the plastic meter face cover, *carefully* removing the scale—usually held in place with two tiny screws—and then applying small dabs of conductive paint (such as GC Electronics Silver Print) to all of the dissimilar junctions that carry current to the meter's armature winding. The conductive paint can be applied with a straightened-out paper clip; it can also be thinned with ordinary acetone to facilitate penetration into any narrow areas between parts. However, be careful not to get it on anything that shouldn't conduct electricity! Also, it should be allowed to dry *thoroughly* before any reassembly takes place, since the fumes could cause problems of their own.

Be very careful when working inside one these little meters, a wrong slip could spell the end for it, but at least give it a try...chances are better than even that you'll be successful, which is a whole lot better than if you'd done nothing at all.

The silver conductive paint that Rich refers to can often be obtained from local electronic suppliers or by mail order from the larger supply houses. MCM Electronics (1-800-543-4330) stocks their catalog #21-1555 Silver Conductive Pen.

An "automatic" antenna disconnect suggestion

If you take advantage of a "master" station-power on/off switch, as do I, to disconnect all power from your station equipment to prevent "unauthorized little fingers" from turning on your ham gear, then here's an extension of that protection for your antenna circuit as well.

Disconnecting your outdoor antenna from your transceiver, when the equipment is not in use, is always a worthwhile safety precaution, in the event of a nearby lightning strike or other static buildup that might occur. It can be made "automatic" very easily, by simply installing a coil-actuated antenna relay in the path between your antenna's transmission line and the station transceiver. Coil-actuated antenna relays used to be quite common in the days of separate transmitter/receiver combinations, to switch the antenna between those two units, before the current trend of transceivers with built-in T/R (transmit/receive) switching. I've often seen them at hamfests, amid other "ancient gear," and at very reasonable prices. If the T/R relay has a 120 volt AC coil, you're all set, just put a cord and AC plug on it, and plug it into your "master" AC strip. If it has a 12 volt DC coil—as might have been used in a mobile set-up—then wire it to your station 12 volt DC power supply's output, as long as the 12 volt power supply is switched off with the "master" switch.

Make sure that the relay's contacts will handle your normal output power—most will—and clean the contacts with a thin strip of 3" x 5" index-file-card material, soaked in contact cleaner, via the relay's contact access port. The contact access port is usually covered with a removable cover plug, or in some cases, the whole cover of the relay itself may have to be removed. It's not usually a very difficult job. Don't file the contacts unless you've had lots of experience with relay maintenance though; they're usually silver (plated or solid) and you can do more harm than good by filing them—use only a paper file card, not a file! A special diamond-dust relay burnishing tool, with proper instructions, is normally used if filing is absolutely necessary.

Now cable the relay in series with your incoming antenna coax, so that your antenna system will be connected to your transceiver's output when the relay is "pulled up." Install a "shorted" coax connector into the leftover fitting, so that the antenna's transmission line is shorted when relay is relaxed—when the station AC power is "off." Finally, ground the body of the relay to a reliable earth-ground to "bleed" any static buildup safely away to the earth.

With your transceiver's antenna lead automatically disconnected, and the antenna itself shorted, you can sleep a bit more comfortably when spring thunderstorms approach. This won't completely protect your equipment from a direct hit (very little will) but it does help to protect your investment from nearby lightning hits and static build-up damage.

Dig out your mobile vertical!

From William Thim N1QVQ, of Broad Brook CT: A winter-wise tip that may still have application this season for some. While you're in the process of cleaning that snow and ice off your car windows, don't forget to dig out your mobile antenna! A buildup of snow and ice around the base of your VHF or UHF mobile whip antenna can significantly raise your SWR, even to the point of forcing your transmitter to cut back on its power output. Check it with a good SWR bridge and you'll see what I mean. Two or three inches of snow built up around the lower active portion of the antenna will often result in a noticeable SWR change.

Bill brings up a good point, though the bottom part of a 1/4-wave vertical is the high-current, low-impedance end of the antenna. Depending upon the amount of snow and ice and the operating frequency involved, the tuning of the antenna — and its losses — can be altered quite a bit. It's something we may not always think of when we're not hitting the repeater quite as well as we used to!

All-purpose probing tool from the Far East

From Herb Foster AD4UA of Melbourne FL comes this suggestion: Whenever I'm working on a piece of electronic equipment, I like to have an insulated tool in one hand to point, probe or gently tap a component or connection that might be suspect. This one is effective and, best of all, free!

Most Chinese restaurants give away bamboo chopsticks to their customers, to kind of get you into the spirit of eating out oriental style. So the next time you have the urge to take in one of these restaurants, save the chopsticks for your workbench tool inventory. When you get back home, wash them and carve one end of each into a point, a flat-blade screwdriver or even a hex-type of core-adjusting tool, and keep them handy on your bench. You can use them to poke around a crowded circuit board without fear of shorting anything out, or even use one to prop something open, if your transceiver is built into "layers" as so many are these days. And if your neck starts to itch, you can even use it to reach behind and scratch!

All you need do to obtain a supply of your own is to develop a liking for Chinese food, then take the wife and kids out for dinner. Even if you don't care to try manipulating your meal with the chopsticks, that's okay too, they'll loan you a fork and still let you keep the chopsticks...and you can't beat the fortune cookie at meal's end either!

Good idea, Herb. Bamboo keeps its shape better than many other woods, so whatever type of tip you might put on the end, chances are it will last longer than pine or other soft wood. By the way, if the fortune cookie says something like: "Avoid anything electronic today," better listen to it—you never know!

Airing taped telephone ham bulletins

From Mike Schroeder N0ALJ of Rogers AR, several ideas for those of you who might be contemplating handling the airing of telephone-line originated amateur radio bulletin services for use on your local repeater's net-night get-together: I've been assigned to air the bulletin services—such as RAIN and Newsline— on our Monday night repeater net on 146.76 MHz, and I felt that I needed the best quality telephone audio possible, plus an easy-to-install record/playback system. Instead of a simple telephone inductive pick-up coil, the Radio Shack™ #43-228 does a much better job, has a built-in speaker, so it allows me to monitor what's being laid down on tape. I also use a multi-memory phone to make dialing easier and so that I can program in alternate numbers, just in case the ones I normally use are busy.

Another interesting method I've found to make quality recordings is to dial up the service you want to record on a cordless phone, then use a scanner to pick-up the radio frequency of your phone, and make a recording from the external speaker jack of that scanner.

As far as playback of the tapes over-the-air on net-night, if you want something simple, you might try an inductive pick-up coil backwards—such as the RS #44-533—if you have a dynamic or magnetic type of mike on your 2-meter transceiver. In other words, feed the tape machine's earphone/speaker audio output into the inductive pickup, and place the coil over your mike. This won't work on the new electret-condenser type microphones, but in that case, the easy to build interface box shown in Fig. 1 can be used.

Using an inexpensive digital timer (such as the Radio Shack #63-884) that's started when the tape is started will give you an elapsed time indicator, so that station IDs can be inserted at the proper times. The tape can be paused for the ID by simply having an SPST toggle switch on a cord, plugged into the tape machine's remote stop/start jack. If fact, all of these functions can be integrated into the one central control box (see Fig. 1) - recorder interface with its mike/tape switch, remote tape stop/start switch, transmitter PTT switch and a small digital timer—all equipped with the correct plugs to mate with your specific equipment. On net night then, it's almost an automatic few-second setup to get things going correctly, instead of a Murphy-prone chore!

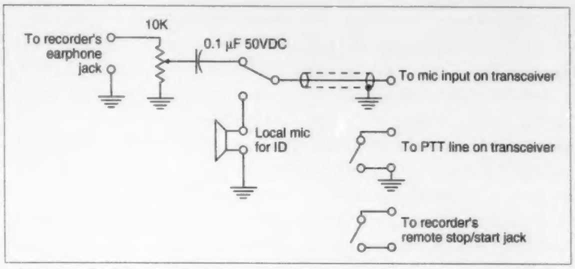

10K
To recorder's earphone jack
0.1 µF 50VDC
To mic input on transceiver
Local mic for ID
To PTT line on transceiver
To recorder's remote stop/start jack

Fig. 1. N0ALJ's Net Bulletin recorder controller.

Good tips, Mike. Building everything inside a metal box and using shielded cabling will help to reduce the possibility of RFI problems during the on-the-air phase of the operation. If you still have problems, try putting small ferrite beads on all the input/output leads, and/or .001 µF disc capacitors from the offending lead to ground. At 2 meters, sometimes a lead will inadvertently end up being either 19" or 38" long, acting as a resonant pick-up antenna for your own signal! Check for that too.

For your files

From Joel Masur AA5YA of DeLand FL: a few good suggestions for working aluminum sheet stock. What follows is an idea that you might want to try if you've ever had difficulty "squaring up" aluminum sheet stock for panels, etc. Try to locate an old time lead body file, mine is a New Britain #285; an auto parts store or older auto body shop might be a good place to start. Mount it on a husky wooden handle, so that it resembles a flattened wooden block plane. The half-moon shaped teeth in a file like this will eat-away at the soft aluminum very nicely, without the normal tooth-clog problem we're all familiar with in finer-tooth files.

Additionally, you might try Forstner wooden bit and power auger files for getting into the corners of the square or rectangular cutouts needed for snap-in switches, etc. The ones I have are 7" long, 1/8" thick and 7/16" at the widest part. They're shaped something like a diamond that's been stretched-out to the 7" length but with a 1/4" wide by 1-1/2" long connection strip. One end of it has teeth on the flat side and none on the edges; the other end is exactly opposite...no teeth on the flat side but teeth on the edges.

Now that you have the tools, what about the stock? Free is always nice, and here's an approach you might want to try. Make friends with the public works department foreman in your town and see if he has any salvaged road signs that he'd just as soon get rid of. They can make great electronics panels if they're not badly damaged. Leave any decals on until you've cut and finished the material for the project you're working on for protection of the under-finish.

Octagonal "stop" signs make nice 2 meter ground planes for a magmount antenna, providing they're made of steel. Other steel traffic control signs can be used for the same purpose if they're sized about right (roughly 40" by 40").

If the public works foreman has any outdated aluminum traffic control counter boxes taking up space, latch onto them; they're the boxes you'll sometimes see placed at the side of the road, chained to a tree, with a long rubber tube coming out of them and onto the roadway. They count the number of cars using a particular road over a period of a few days, but the discarded ones also make great boxes for outdoor tuning units, power supplies, or even an entire mountain-topping QRP station! The air hose hole can serve as an input/output access. Just be sure to go through the right channels when helping them to get rid of their obsolete signs and boxes; you don't want to be operating portable from the police department's holding cell!

If the auto body shops you check with don't have the files that Joel is referring to, ask them where they purchase their supplies and try directly. You might also check with the W.W. Grainger outlet nearest you, as well as any other contractors' supply houses in your area.

Quick tip for testing transistors

From Peter Albright AA2AD of Lakewood NY: This suggestion for quickly testing out-of-circuit transistors. Here's an easy method of using a multimeter's "ohms" scale to reliably test transistors. The very few minor limitations are as follows:

1. It works best with an analog (needle style), rather than a digital meter.
2. It should only be relied upon when the transistor has been removed from circuit.
3. The test works on bipolar transistors only, not on FETs, SCRs, etc.
4. It doesn't yield any information on a transistor's gain or "beta."

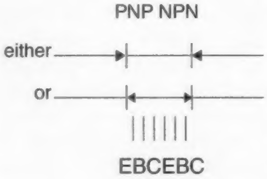
The limitations, in my opinion, are more than offset by these advantages:

1. The test is fast and requires no specialized equipment.
2. You will get no false "defective" results.
3. The only false "good" result might be from a thermally-sensitive transistor, i.e. if the transistor only shows a defect under the stress of heat during actual operation.
4. It can often be used as a first step in identifying lead configuration.

Here's the theory: There are two types of semiconductor material, "P" type and "N" type. A junction diode, such as a silicon power diode, consists of one layer of "P" material mated against one layer of "N" material, and this junction conducts current in one direction only.

Bipolar transistors, on the other hand, always consist of three alternating layers of these three materials — either "PNP" or "NPN" — with a wire connected to each of those three layers. To an ohmmeter, which has only two test leads, the transistor looks like two diodes, either back-to-back, or face-to-face. This concept alone takes a lot of the mystery out of transistors.

Regardless of which type of transistor is being tested, the wire to the center layer is the base, while the two outside layers are the emitter and the collector. So the configurations, when drawn as diodes, are:



In practice, it's really easy to test a diode with an ohmmeter. Set the meter to the R times 1K range. Measure the resistance, first in one direction and then in the other, by reversing the ohmmeter's test probes. Silicon diodes will measure virtually infinite resistance when the positive probe is connected to the diode's cathode (usually marked by a band). Conversely, they'll measure some continuity when the positive probe is connected to the anode. Note that not all multimeters apply a positive voltage to the red meter lead; you'll have to test your own meter with a known good diode first, then mark the meter as to which test lead is actually outputting a positive voltage. It need only be done once. Germanium and selenium diodes on the other hand, which are point-contact diodes, rather than junction diodes, may show some continuity in both directions, but the amount of continuity in one direction, will always be much higher than the other, if the device is good.

If you're still with me, you've probably already figured out how to test a transistor with an ohmmeter, thinking of it in terms of two diodes. Here's the procedure, in step-by-step format:

1. ALWAYS turn the equipment off, unplug it or remove the battery, and discharge any filter capacitors — usually identified as the physically larger capacitors.
2. Remove the suspected bad transistor by carefully unsoldering it from the circuit.
3. Set your ohmmeter to the R times 1K scale or higher. This limits the testing current, protecting the transistor from damage. Don't use the very low ranges on your meter for these tests.
4. Connect either lead of your ohmmeter to what you believe to be the base of the transistor.
5. Measure the resistance to each of the other two leads. The reading should be the same for both leads: either nearly infinite (open) or finite (some continuity).
6. Now switch probes: that is, connect the other probe tip to the base.
7. With the probes now reversed, measure the resistance to each of the leads once again.

The reading should again be the same for both leads.

a.) If your result the first time around was "infinite," then you should now see some continuity between base and emitter as well as between base and collector.

b.) If your first round results showed "continuity," then your measurement now should be nearly "infinite" resistance (open) to both emitter and collector.

8. If you get some result other than these, then assume that the transistor is defective.

Notes:

a.) As with germanium diodes, germanium transistors may show some continuity in both directions, but there will be a distinct difference in the resistance when you reverse the probes. You probably won't find many germanium transistors in equipment less than twenty years old, but you will find germanium diodes in more recent gear.

b.) If the transistor is bolted to a metal heat sink and has only two leads coming out of it, then the bolt tab or threaded stud will be the third connection. Bolt tabs and studs are always the collector.

c.) If you don't know the lead configuration of a device, you can use this technique, along with trial and error, to at least identify the base lead, provided the device isn't defective.

If you REALLY understand this technique, it can save a lot of time and trouble, as well as taking some of the mystery out of transistors and solid-state electronic troubleshooting in general.

Peter's suggestion is a good one to remember; it's a good "quick test." It might pay to clip this out and post it near your workbench, so that it's handy the next time you need it. It would also pay to practice on a few good transistors, now, just to get a "feel" for what he's saying and to overcome any reluctance you might feel toward solid-state troubleshooting. Hands-on learning is always worthwhile; after all, you can't do much harm...and it's good hand-to-eye coordination practice!

TNX to those who have contributed to this month's column:

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A Simple One-Hour

Continued from page 40

The few components can be mounted on a terminal strip. R1 is best attached to either the rear of the meter case or the interior of the enclosure, using epoxy, superglue or hot glue.

Calibration

Look at your meter scale. With luck there will be four main divisions. If not, carefully take the meter apart and divide the meter scale into four equal, 10-volt divisions, using a fine tip felt pen. Mark these points 90, 100, 110, 120, 130, starting at the zero end of the scale as follows: The space between 90 and 100 is one division; between 100 and 110 is division two; between 110 and 120 is the third division; and the final division is between 120 and 130 at full scale. Reassemble the meter and mount it in its enclosure.

If you are unfamiliar with disassembling meters, please see my article, "Use Those Surplus Meters," *73 Amateur Radio Today,* January 1992, page 42.

With your meter scale properly calibrated and all parts mounted in the enclosure, adjust R1 to maximum resistance. Using an accurate AC meter—a digital multimeter is preferred for accuracy, but a V-O-M can be used—measure the AC voltage at the nearest outlet, and note this value.

Plug in the Line Voltage Monitor. Being very careful not to touch any points carrying voltage, adjust R1 so the meter indicates the same voltage you measured previously. This completes calibration.

Operation is automatic. When this instrument is plugged into a live 117 VAC outlet it will continually monitor the level of voltage supplied by the power company.

Notes

Be sure the meter you use has a moving coil (D'Arsonval) movement. Do not use an iron vane meter. If you can't tell the difference at a glance, a good rule of thumb is: If it looks expensive, it probably is a D'Arsonval meter. If it is round or square and has a cheap-looking black painted metal case held together with bent metal tabs, it is probably an iron vane meter.

There are similar-looking line voltage meters commercially available costing about $20. Some of these appear to use an iron vane meter. You can build a better monitor for a lot less money.

A major disadvantage of using an iron vane meter to which a voltage is applied continuously is that they lose accuracy as the movement becomes magnetized. You'll find that, if you unplug one after a year in use, the needle will not return to the left end of the scale. Instead, it will indicate some level of voltage even though none is being applied.

An excellent and inexpensive source of surplus name-brand meters with D'Arsonval movements is Fair Radio Sales, Box 1105, Lima, OH 45802. A selection of five meters (their choice, not yours), Catalog No. 47-84, costs $10. Mostly basic 0-1-mA movements will be in each selection. Usually there will be one, possibly two meters with 100-µA movements. Some may have internal shunts, multiplier resistors, or rectifiers, but these are easy to eliminate, leaving you with the desired basic meter movement. This gets you your meter for only $2, and you still have four more nice meters for future projects!

Johnson Matchbox

Continued from page 47

Further Reading

1. Witt, F. (AI1H), "How to Evaluate Your Antenna Tuner- Part 2," *QST* May 1995
2. Magnusson, John E. (W0AGD), "How's Your Antenna," *CQ* January 1962, p. 27. Picture is of the kilowatt version of the Johnson Matchbox.
3. Marriner, E. (W6XM), "Another Antenna Tuner," *Ham Radio*, May 1983. Describes building a dual differential variable capacitor. Shows construction of one-half of the Matchbox circuit for use with a balun or unbalanced loads.

References:

1. Mitchell, J.D. (K4IHV), "MatchBox Plus Two," *Ham Radio*, July 1979. Describes a modification of the Johnson Matchbox.
2. Maxwell, M.W. (W2DU), "Reflections," The American Radio League, 1990, p. 13-14. Comments on the theory of operation of the Matchbox circuit.

Debunking Some Myths

Continued on page 40

HAM TO HAM

Continued from page 58

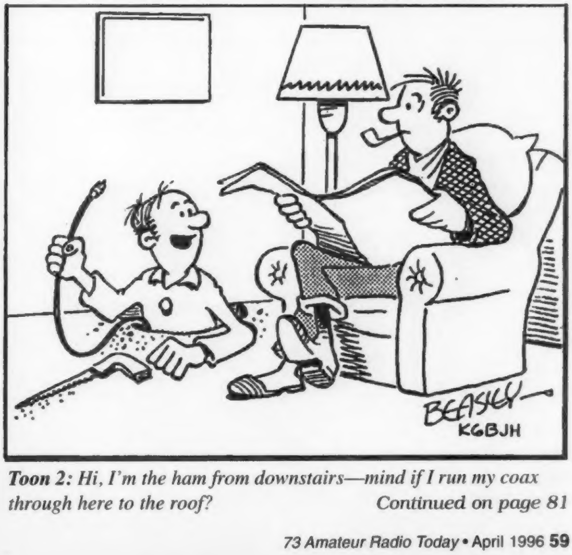
item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or 73 for any equipment damage or malfunction resulting from information supplied in this column.

Please send all correspondence relating to this column to 73 's "Ham To Ham" column, c/o Dave Miller NZ9E, 7462 Lawler Avenue, Niles IL 60714-3108, USA. All contributions used in this column will be reimbursed by a contributor's fee of $10, which includes its exclusive use by 73 . We will attempt to respond to all legitimate contributors' ideas in a timely manner, but be sure to send all specific questions on any particular tip to the originator of the idea, not to this column's moderator nor to 73 .

Calling Young Hams!

Carole Perry WB2MGP is looking for youngsters under the age of 18 who are enthusiastic about amateur radio to contact her about appearing at the DAYTON 96 HAMVENTION this year. Kids should have good speaking skills and be at ease in front of an audience.

Please write or phone at PO Box 131646, Staten Island NY 10313-0006; (718) 983-1416 **ASAP**. Have some fun, network with other hams, and wouldn't this look good on your college applicationss?



***Toon 2:** Hi, I'm the ham from downstairs—mind if I run my coax through here to the roof?*

Continued on page 81

Number 60 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
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A Little Hank of Wire

One of the problems in getting on the air, especially if you are short of cash, is the little matter of the antenna. One can spend anywhere from $29.95 to $5995.00 for an HF antenna for the ham bands, especially if one wants multi-band operation. In my early years of hamming I was perpetually broke, so learned first hand how to do things on the cheap. A couple hundred feet of wire and coaxial cable is not terribly expensive, but can make a dandy antenna.

Most of us are familiar with the half wavelength dipole, but it isn't the be-all and end-all of HF wire antennas. One of my favorites, and one of the earliest antennas that I used, was the Windom. The first Windom I saw was used by my mentor, the late Mac Parker W4II, although he wasn't enamored of it. We also had a Windom antenna on the roof of the Industrial Arts building of Washington-Lee High School (Arlington, VA) where K4BGA was the club call sign...and it worked a lot better.

The Windom antenna (Fig. 1) has been popular since the 1920s. Although Loren Windom is credited with the design, there were actually a number of contributors. Coworkers with Windom at the University of Illinois were John Byrne, E.F. Brooke, and W.L. Everett, and they are properly co-credited. The designation of Windom as the inventor was probably due to the publication of the idea (credited to Windom) in the July 1926 issue of *QST*. Additional (later) contributions were rendered by G2BI and GM1IAA (Jim MacIntosh). We will continue the tradition of crediting Loren Windom, with the understanding that others also contributed to this antenna design.

The Windom is a roughly half-wavelength antenna that will also work on even harmonics of the fundamental frequency. The basic premise is that the antenna radiation resistance varies from about 50W, to about 5,000 W, depending upon the selected feedpoint. When fed in the exact center, a current node, the feedpoint impedance will be 50 W; similarly, end-feeding the antenna finds a feedpoint impedance of about 5,000 W. In Fig. 1 the feedpoint is tapped away from the center at a point that is about one-third (0.37L) the way from one end, at a point where the impedance is about 600 W.

The feedline for the basic Windom of Fig. 1 is an insulated length of wire. Of course, the size of the wire depends on the power level, but I suspect that #14 insulated stranded wire will do for most people who run less than 200 watts of power. Indeed, I wouldn't like to use a Windom at high power levels because of the "RF in the shack" problem.

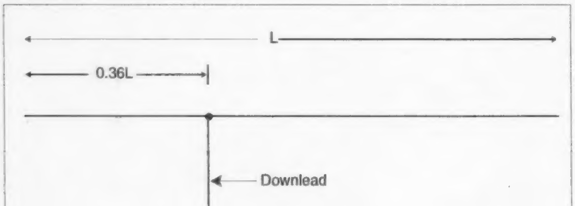

Fig. 1. The basic Windom antenna.

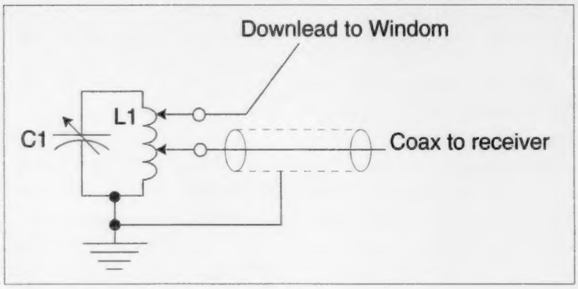

Fig. 2. Antenna tuning unit for Windom.

The Windom antenna works well....but with some serious caveats. For example, the antenna has a tendency to put "RF in the shack" because it is voltage-fed. Second, there is some radiation loss from the feedline. Finally, the antenna works poorly on add harmonics of the fundamental frequency.

The antenna tuning unit can be either a parallel resonant, link-coupled, LC tank circuit (see Fig. 2); or a reversed pi-network. In the case of the Windom, the pi-network is turned around backwards from the usual configuration: C1 is at the low impedance end of the network, so it is larger than C2. Design a pi-network to match 50 = on the transmitter end, and 600 = on the antenna end.

Note that a good ground should be used with this antenna (note the ground connection at the output of the antenna tuning unit). This means (for most people) an eight-foot ground rod, or a system of radials.

A reasonable compromise Windom, that reduces feedline radiation losses, is shown in Fig. 3. In this antenna a 4:1 balun transformer is placed at the feedpoint, and this in turn is connected to 75 W coaxial transmission line to the transmitter. A transmatch, or similar antenna tuner, is then connected between the transmitter and the transmission line.

An Old Myth Revived?

There are a number of myths that are widely held among radio communications hobbyists...and amateur radio is no less infested with some of these myths than others (CB, for example). Twenty-five years ago I worked in a CB shop in Virginia, and we kept hearing one old saw over and over again: you can cut your coax to reduce the VSWR to 1 (actually, they meant "1:1" but routinely called it 1). Hordes of CBers have cut the coax and watched the VSWR reduce to 1:1, so they cannot be talked out of the error. What actually happens in that case is a measurement difficulty that makes it appear to be true.

Of course, Hams are superior to CBers so don't believe that error, right? I'd like to think so; but having been in both the CB and the amateur worlds, and "Elmered" more than a few CBers studying for amateur licenses, I have to admit that at least as many amateurs believe the "cut-the-coax" error as CBers (sorry, fellows, but that's my observation). Recently, a couple questions on this topic arrived in my E-mail box (carrjj@aol.com).

The only really proper way to reduce the VSWR to 1:1, in my opinion, is to tune the antenna to resonance. For a center-fed half wavelength dipole, or a bottom-fed quarter wavelength vertical, the proper way to resonate the antenna is to adjust its length to the correct point. The formulas in the books and magazines only give approximate lengths...the real length is found from experimentation on the particular antenna after it is installed. Even commercial antennas are adjusted this way. On certain CB mobile antennas, for example, this trick is done by raising (or lowering) the radiator while watching the VSWR meter. On amateur antennas similar tuning procedures are used.

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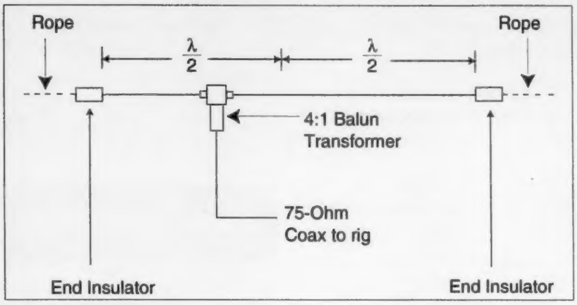

Fig. 3. 4:1 Balun

Another ploy used by amateurs (including myself) is to connect an antenna matching unit (tuner) at the output of the transmitter. For my Kenwood TS-430, I use either a Heath SA-2060A or an MFJ Differential Tuner to "tune-out" the VSWR presented by my Hustler 4BTV and 75 feet of coax. But I don't even pretend to be tuning the antenna. The TS-430 is a solid-state rig, and the finals are, therefore, not terribly tolerant of VSWR, and will shut down with a high VSWR. The purpose of the antenna tuner is to reduce the VSWR seen by the transmitter...and to heck with the actual antenna mismatch on the roof. The tuner also serves to reduce harmonics further, thereby helping to prevent TVI. The best form of antenna tuner is one that both reduces the VSWR (for the benefit of the transmitter), and also resonates to the antenna frequency, preventing harmonics from getting out (a dirty little secret is that many "line flattener" ATUs are actually variable high-pass filters, and must be used with a low-pass filter ahead of them if spurious signals are to be kept at home.

Clarification

I received a number of queries in my America On-line mail box about the "Quick 'n' Dirty Twin-Lead Antenna" discussed in this column a couple months ago. I still get feedback on that antenna, and have made at least one correction on it, but the questions continue, so here goes again. The two conductors at the far end of the twin-lead are shorted together. If you check the continuity of this antenna with an ohmmeter at the feedpoint end you will read a short circuit (or only a few ohms of DC resistance, depending on length). The antenna is not left open, or will not work.

Another requirement not made all that clear in my article is the fact that this is basically a form of Marconi antenna, so needs a very good ground to work effectively. As mentioned above, this means that you should get an eight-foot copper-clad steel ground rod, or lay in a system of radials. I should have mentioned that originally, but somehow it slipped my mind until a couple of experienced, sharp-eyed readers spotted the error. Sorry.

Connections...

I welcome your comments and questions, as well as ideas for this column. My snail mail address is P.O. Box 1099, Falls Church VA 22041, and my Internet E-mail address is carrjj@aol.com. 73

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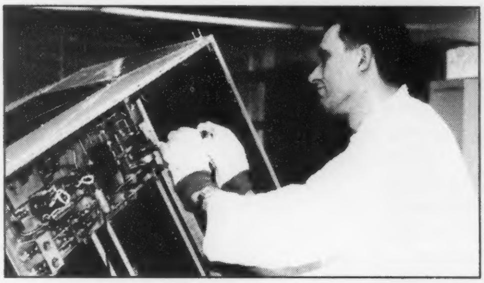

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Been there? Done it? Try life in the QRP lane.

There seems to be an increase in hams (re)discovering low power operation. Called QRP, it's an interesting way to get back into ham radio after you've done it all!

Several years ago, we looked at some of the frequently asked questions about QRP. There seemed to be a pattern, so I recently went through piles of letters and picked out some others. Here is an updated version with even more frequently asked questions answered—in no particular order. Enjoy!

What are the most popular QRP bands?

There really is no one band more popular than others. You'll find QRP operation from DC to light, but most QRP activity may be found on the 40-meter band around 7.040 MHz. Also check 7.035 MHz as well as 7.060 MHz for QRP operators. You'll find many of the European stations lurking around 7.030 to 7.035 MHz. Start with 28.060 (although it's not carved in stone) as the 10-meter QRP calling frequency. The 30-meter band is a QRPers delight! Try 10.106 and up for low power signals. There're lots of HF packet on the very high end of 30 meters. If you have a QRP rig that will operate SSB, give HF packet a try.

Let's not forget about the 20 meter band either. This is by far the most popular ham band when it comes to working DX. Low power operation used to be located around 14.060 MHz, but alas, other forms of digital signals have been moving down, overtaking the QRP calling frequency. Check the entire band for QRP operators; they're everywhere on 20. Fifteen meters is also quite popular, but with the current lack of sun spots, activity is a bit sparse. Always check the band, however, at or near 21.040-21.065 for QRP operators.

"I'm not 'into' CW. Can I still operate QRP?"

CW is by far the most popular mode of use for QRP operation, partly because CW transmitters are easier to build than SSB rigs. With CW, you get more bang for the watt too. But QRP is not only CW; it's any mode you want to use, be it FM or SSTV. Remember QRP means low power—not CW only.

There's been an increase in activity on 6 meters due to the influx of multiband mobile rigs. Don't let it throw you. A inexpensive 6 meter transverter is now available from TenTec at a very reasonable price.

The #1 absolute *must* on 6m is a good antenna. A wire between two bushes just won't do. A chopped up and converted CB beam antenna makes an ideal and inexpensive beam for six meters.

"Do I need to change rigs or equipment to operate QRP?"

Of course not! Most of today's rigs can be easily turned down from a front panel control. You'll end up with low transmitter efficiency, but you won't have to spend a dime either. The Index Lab rig covers all ham bands, plus a general coverage receiver. The rig operates on SSB and CW; it will set you back $700.

"How about antennas? All I have is a simple dipole."

No matter what the power level in an amateur radio station, the better the antenna, the better your signal will get out. Use a good grade of feedline and get the antenna as high as possible.

"I enjoy a good contest now and then. How can I compete with other stations if I run 2 watts?"

Most of the bigger contests such as the CQ World Wide DX contest, Sweepstakes and even Field Day have special low power sections. You only compete against others within the same power class.

"The bands are dead, as is my final; now what do I do?"

Surf the net! There are 700+ members on the Internet QRP-l group. To subscribe to the newsgroup do the following from your web browser or mailer: Send an E-mail to listserv@lehigh.edu in the body of the message type SUBSCRIBE QRP-L

Then follow with your name and call.

Yup! It's that time again!

The Dayton HamVention will be May 17-19 this year, so mark your calendars! The QRP ARCI will be hosting a weekend-long QRP session at the Day's Inn at the South Dayton Mall. Things begin Thursday and wind down Sunday afternoon. As usual, the QRP ARCI has several blocks of rooms reserved. If you want to stay with us, call Myron Koyle at (216) 477-5717 to reserve your room. If you were with us last year, and you filled out one of the yellow 1996 application forms, you're all set. However, if there should be a change in your plans, be sure to get in touch with Myron to update his files.

The QRP ARCI will also host several talks during the HamVention. Saturday night will be our awards banquet. There is always something to see or do at the hospitality suite before and after the banquet. Along with the QRP ARCI in Dayton will be the Michigan QRP club, the NorCal club, the G-QRP club and a boatful of others.

There are all kinds of things to do at Dayton for the QRP-challenged! Many of the companies that specialize in QRP equipment showcase their newest creations at Dayton. Dick GØBPS from Kanga always brings the cutest gizmos from G-land. So, if you want a whole weekend of QRP, then set aside a few days in May. Remember, the date has been changed! The Dayton HamVention is now the week ending May 19, 1996.

Bring your stories of the rarest DX—any time you're more than 25 miles from home, you're an expert! Bring a carrying pouch, so you can lug home your very own DX-100! Bring lots of money, for all those things you really don't need! And bring your wife; she'll keep you in line. Hope to see you there! 73

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NEVER SAY DIE

Continued from page 55

really good at it. And I cleaned out all of the crap in my mind that had been defeating me. That's when I started reading and learning. Not long after that I started my first entrepreneurial businesses and made my first million.

But what I found was that I had the key to helping anyone get rid of the mental baggage that was making them sick and keeping them from being successful. Only I also found that almost no one had any desire to change. I was able to help people get out of insane asylums and lead productive, happy lives. But most people in asylums fought change. So I said to hell with it and started manufacturing loudspeakers.

At these science conferences I meet lots of people with great ideas, but without the gumption to capitalize on them. Steve Jobs would have gone nowhere without Mike Markkula, who's the guy who really made Apple. If Jobs hadn't screwed things up many of us would be using Apple IIt computers zipping along at 250 MHz instead of IBM clones. Or even Macs. Unless you have a memory of my editorials you probably haven't heard of the 65816 and 65832 chips Wozniak wanted to use to update the IIc. And that was just the beginning.

Start reading some of the books I've been recommending. Start meeting me at some conferences. Hey, buy me a lunch! Or maybe, if that's too much trouble, get your hamfest chairman to bribe me to take off a couple days and give a talk so I can whip some life into the turkeys around you. I might be able to get them to lose some of that lard hanging over their belts and clouding their brains. I might get them to actually think. Maybe not. Can I get them to start reading? I keep asking you to let me know of any book "I'm crazy if I don't read." I don't want to hear about good books, interesting books, or fun books. I want to hear about truly great books…and don't forget the address of the publisher so I can get a review copy. You already know I'm thrifty (aka cheap). If you don't, then you haven't been enjoying my travel books. I suppose I should put all them together into one big book the way Michael Crichton did. Hey, I've got to add his "Travels" to my list of must-read books. I'd forgotten about it!

If I can fit it into my schedule I'll come and talk at any hamfest where you can get at least 300 people together. And then pay for me and Sherry to make the trip, plus help me sell some of my books and magazines? Get me there a day early and arrange for me to be on the local radio and TV news and interview shows to help build attendance for the hamfest. I talk about so many things that you'll have to buy a tape of my talk to remember everything. I usually get into health, longevity, how to make money, hamming, new technologies, education, and so on.

This is a hobby!

A whole sheaf of papers landed on my desk describing what appears to be a three year total waste of a whole lot of people's time and money battling over a Southern California repeater. The bottom line is that yes, we sure do have some remarkably stupid jerks with ham tickets and no practical way of getting rid of them. If only it were as easy

Continued on page 76

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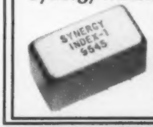

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ABOVE & BEYOND

The Care and Feeding of a VHF-to-Microwave Enthusiast

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Who and what is the San Diego Microwave Group? Do you have a newsletter? Does your group charge membership dues? How many members interested in microwave do you have? How did you get started in microwave operations and how do you keep a group together? What is it like to start a group-interest forum based on microwave and related subjects? How do you manage to keep interest going in today's ever-changing world? What type of microwave equipment does your group use?

Well, these and a few other questions are the most often asked of the San Diego Microwave Group. First, ours is not the only group involved with microwave. There are many other groups, all of which promote microwave communications, interest in build-it-yourself, and operation on our VHF through microwave bands. The San Bernardino Microwave Society, the North Texas Microwave Society, and the Pack Rats in the Northeast are just a few.

All of these fine groups act in concert, and depend on amateurs' willingness to disseminate individual and group technical knowledge to other amateurs through newsletters and technical sessions. It is this spirit of cooperation and sharing that has promoted a new interest in microwave activity and a resurgence of home microwave construction projects. It is in this arena that I am able to explore my most rewarding amateur activities, home brewing or converting a surplus item to a usable device for our amateur microwave bands.

I'd like to describe the San Diego Microwave Group's position. We try to put our best efforts forward in methods and technologies for new microwave construction projects. Part of our goal is to explore new bands and populate them, and examine the different propagation effects on that band, be it microwave or laser technologies. Sometimes it seems that we expend a lot of effort to jump up to a new frequency. I assure you that it is difficult trying to locate new, usable pieces of microwave equipment. Quite possibly we do it for the "rush" we get locating and constructing these devices.

It might seem comical to some, but we enjoy the chase and construction aspects of this realm of frequencies. Our group has modified many different commercial satellite microwave devices, converting them for use on amateur bands. The components can be hard to locate, but once built into a usable system can provide a platform for state-of-the-art systems and testing different forms of propagation. It's kind of like operation in a new frontier where you can't just dash out to the store and buy the equipment. Almost all of the equipment required is home-constructed. The first axiom: You must have a very good relationship with your soldering iron, or at least be prepared to become attached to it.

If radio communication and operation is your thing, why go to remote hilltops and other locations when the same communication could be done easily on other, lower-frequency bands? This seems to be the biggest question presented to our respective microwave groups. See if this makes sense to you. You can *catch* fish with a net and be very successful, but if you enjoy *fishing*, you might want to try the cutting edge of the sport — fly-fishing. It might not be as successful as to quantity, but proficiency with your method means you make up the difference in personal satisfaction.

The pleasure gained from fly-fishing can be compared with the same feeling of accomplishment and success that has re-inspired and invigorated amateur radio construction. As for my personal microwave communications experience, it's like going back to my early years of excitement and enjoyment fabricating much simpler tube-type equipment scrounged from old (1960s) TV receivers, etc. Just as it was in the beginning (sounds like a fairy tale) the initial excitement of constructing a simple crystal radio in the 1950s is renewed through microwave construction in the 1990s.

The San Diego Microwave Group was formed by interested radio amateurs to promote and develop circuitry and equipment using microwave frequencies and various modes to communicate with other amateurs. We do not publish a newsletter or charge dues, although some day we might have a newsletter when we can get the energy off the workbench and onto the keyboard. Until that time, this column has been (and will continue to be) the sounding board for interesting new projects that have polished our abilities and operational skills. We have tried new methods of discovery and learned a lot in the school of hard knocks.

Hopefully we have smoothed out some different applications and equipment to improve our circuitry, making operation easier and more enjoyable. If I couldn't draw on the experience and resources of our group, using their excellent technical abilities, this column would be diminished. The constant sharing of initiative modifications, and technical upgrading of various microwave systems enables me to present them to you; it's what makes our group click.

Information is distributed to our group members via two methods; one is our monthly meeting on every third Monday at the home of N6IZW. It provides eyeball QSOs along with equipment adjustments and tests. Our meetings are informal gatherings around a table of new widgets to be described or tested at the beginning of the meeting. Later we adjourn to a group discussion.

The second way to keep our group together and distribute information is to have an informal roundtable on the 2 meter Palomar repeater at 9 PM every Monday evening except the 3rd Monday of each month. (The Palomar repeater is located in Southern California and operates on 146.73 MHz, 600 kHz down. It is located on Palomar Mountain near the Hale or Mt. Palomar 200 inch telescope.) Discussions on these Monday nights range the gauntlet from simple to very technical operations. The topics are usually left up to the individuals checking in to the net—questions or information on new equipment or apparatus to share.

That's the basic premise of the "nets" that our group and similar other groups of amateurs have started. The primary function of a "net" is to pull in interested amateurs from all aspects of the hobby to inform them on VHF and above related topics, and to pull them into our world if they are interested. As with any venture, be it business or otherwise, if you don't advertise you don't get exposure. Exposure—that's all it takes to set up your own Microwave Group.

The San Diego Microwave Group was started through the efforts of Red Truax W6BLK. Red was a long standing member in the San Bernardino Microwave Society and wanted to start a similar organization here in San Diego, because of the 80 or so miles separating eye-to-eye discussions, and the effort required to attend meetings in San Bernardino. In the very early days Red had some stationery printed with the SDMG's logo on it and had several plastic ID badges made with the same logo and our call signs. Kerry N6IZW and I were among the small original group.

The badges were a gift from Red for the SDMG's first members. I remember well going to swap meets with Kerry and making short distance Gunnplexer 10 GHz contacts from two different parking spots at a drive-in theater where the swap fest was held. The operation at the swap meet was our "net" and it assembled a large group of interested amateurs who did not know, at that time, how to contact others who had a similar interest. The "net" or show-and-tell at the swap meets was very successful as we soon had about 20 interested amateurs, all with similar goals and construction interests, microwave. Wide band FM operation on 10 GHz was in full swing.

Red participated in many of these early contact sessions and attended many meetings, showing a great heart and compassion for construction, and diving into microwave circuitry. I'm grateful to Red, who nudged me into this field. Unfortunately, Red's health was not good and he became a silent key, but not before he saw the beginnings of our group flourish. He envisioned and urged us into this realm and we do not forget him. We still have the badges he presented to us in those early days to remind us of his influence.

Why did we select 10 GHz to function with as a primary frequency and not some lower frequency? Well, when your current equipment was up to 450 MHz, at that time the jump to 10 GHz was quite a leap. However it was not made without lots of thought. We envisioned that 1296 MHz was similar in operation to 450 MHz in practice. The equipment for 2304 MHz, 3456 MHz and 5760 MHz was hard to obtain; surplus Gunn oscillators were being dumped on the market for 10 GHz. We just took advantage of the availability of the 10 GHz Gunn Burglar alarms and garage door openers that were starting to appear on the swap meet circuit in large numbers. We used the inexpensive materials and developed it into a wide band FM transceiver operating full duplex.

Power output was in the 10 milliwatt range, frequency was a little drifty and difficult to set. Waveguide absorption wavemeters allowed frequency to be set on a field day hilltop to ± 3 MHz accuracy. Sure it was a fishing expedition, but an enjoyable one. The equipment was inexpensive and the outdoor activity was quite amazing, making contacts over 100 miles in distance with this flea power on microwave. The receiver, by the way, was a single 1N23 type diode in the transmitting waveguide, feeding a 30 MHz pre amp and IF single chip FM receiver. This chip receiver was sort of like Dick Tracy's wrist watch radio; a receiver in a single 16 pin plastic chip TDA-7000 device from Signetics.

There have been lots of developments and relevant circuitry changes since our beginnings in the late 1970s when we used wide band FM equipment exclusively; the TDA-7000 WBFM single chip receivers. We still have this equipment today. However it is not used, but is ready for action if there is a need. Generally we take it out for those who still operate WBFM in the ARRL 10 GHz contests held each year in September and October. While WBFM use is declining, it is still a beginner's low cost method to get on microwave operation. Our group still has this equipment ready for use, in keeping with our goal of helping anyone make a contact, whatever mode they might have to use, be it WBFM, SSB or CW. After all, a new mode and equipment for microwave operation is not the easiest to get running right for your first contact. Mastery takes time and experience.

The equipment that The San Diego Microwave Group uses today is a far cry from our modest beginnings and WBFM. I stress that point because we can get so wrapped up with our latest and greatest and forget that there are amateurs who have not developed a system similar to ours. If we become too narrowly focused we will lose sight of newcomers' interest levels; newcomers who can become just as involved as we are now, but first must learn some of the steps we've taken. In other words, don't leave someone behind in the dust. If you are going to form an interest group, be prepared to work at *many* levels of interest. Offer help and answer questions for all who show interest. After all, the primary goal is to have lots of fun with amateur radio.

I thought I would close with a brief description of our latest 10 GHz microwave transceiver club project. As far as I am concerned you can't do better, considering that this unit was converted from surplus material much like our earlier units that were capable of SSB / CW / narrow band FM operation. Our older units were a series of single boards connected with coax, and consisted of about 10 individual modules. The new unit is a single main module with an external synthesizer and power supply. The complete main PC board is 4" by 5 1/2" and less than 1" high. Quite a remarkable system.

The main board uses Gaas FETs for both receive and transmit amplifiers and has two onboard RF mixers, along with a local oscillator (LO) multiplier and LO distribution amplifiers; it's very sophisticated for amateur operation. Comparing the sensitivity and operational condition of this unit to WBFM is like comparing a skateboard (WBFM) to a Lincoln (SSB). With SSB systems our frequency is synthesizer controlled referenced to a stable quality 10 MHz TCXO time base. We have come to expect frequency errors on 10 GHz to be less than our SSB bandwidths of 2 to 3 kHz. In many instances frequency accuracy is in the hundreds of Hz.

This high accuracy frequency removes uncertainty and really helps make contacts. It's almost like 2 meter operation. Experimentation with bounce and reflection paths vs. direct path contacts are a joy to observe with their Doppler and other "special effects" that change the microwave signal. Home brewing, surplus conversion and other factors add enjoyment to our hobby that you can't get ready-made out of any box.

The difference in these new designs, as with any new circuitry, is that the old system must be either rebuilt or discarded for the newer mode of operation. In this case WBFM equipment is not usable or compatible with SSB operation and must exist by itself. The SSB equipment must be constructed from the ground floor and the real penalty is the added cost for circuitry improvements. Did we find that going to SSB was worth it? You bet! I believe if you are bitten by this microwave bug you'll go for it.

Well, that's it for this month. As always I will be glad to answer questions concerning this and other related topics (please send an SASE). I have also set up an Internet connection for questions, notes and updates in general. My Internet address for questions and news is: clhough@aol.com. Until next month, 73 Chuck WB6IGP.

Photo A. *Ed Munn W6OJY operates an early WBFM full-duplex transceiver used to win the first ARRL 10GHZ contest. The San Diego Microwave Group helps keep us at the cutting edge of this kind of technology.*

Radio Fun

Communications Simplified, Part 4

by Peter A. Stark K2OAW
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Mt. Kisco NY 10549

Having looked at the types of signals we may want to communicate, let's next look at some methods for sending them through wires and fiberoptic cables. Some of the methods we will describe depend on ideas and concepts which we will not cover until later; hence this discussion will be fairly low-level. We will fill in some more detail later, as we learn more about the theory.

Wire communications

When you use a wire connection to send a signal from one place to another, you generally need a minimum of two wires to do it. That's because the wire will need to carry some current (even though that current may be tiny), and you need a complete circuit for the current to flow. So is it possible to communicate with just one wire? The answer is yes...sort of. Let me give you a rather interesting example.

When I was in college, I lived in a dormitory where many of us enjoyed listening to music. But this was in the days before compact discs and tapes could give us an hour or more of non-stop music, and many of us were too lazy to get up every 15 or 20 minutes to change the record. So some enterprising student came up with a scheme for wiring up the dorm so that anyone playing a record could feed that music to anyone else in the dorm who would like to listen to it. We had a 12-wire cable strung around the dorm which carried 12 channels of audio (this was before the days of stereo.) Whenever you wanted to listen to music, you'd first look at the 12 wires to see if someone was playing something you liked; only if you couldn't find something interesting would you need to play your own record; if there was an unused wire at that time, you would send your music into it for others to enjoy as well. In a sense, this was a great cooperative effort at community "broadcasting." (It was also fun to have 20 students all place their speakers in the window at midnight, and all play the same bugle call record at maximum volume at the same time. But that's another story.)

Fig. 1 shows how the system was wired. Each of us in the entire dorm would ground our hi-fi system to the radiator in our room. In addition to feeding the speaker, the output of the sender's hi-fi amp (which came from an output transformer) would also go through a 1/8-ampere fuse to one of the 12 wires in the cable; the purpose of the fuse was to protect the amplifier and speaker in case someone accidentally connected the wire to a power line. Anyone wanting to listen to that channel would then connect an AUX input on his system to that wire through a 100k-ohm resistor, which was also there for protection.

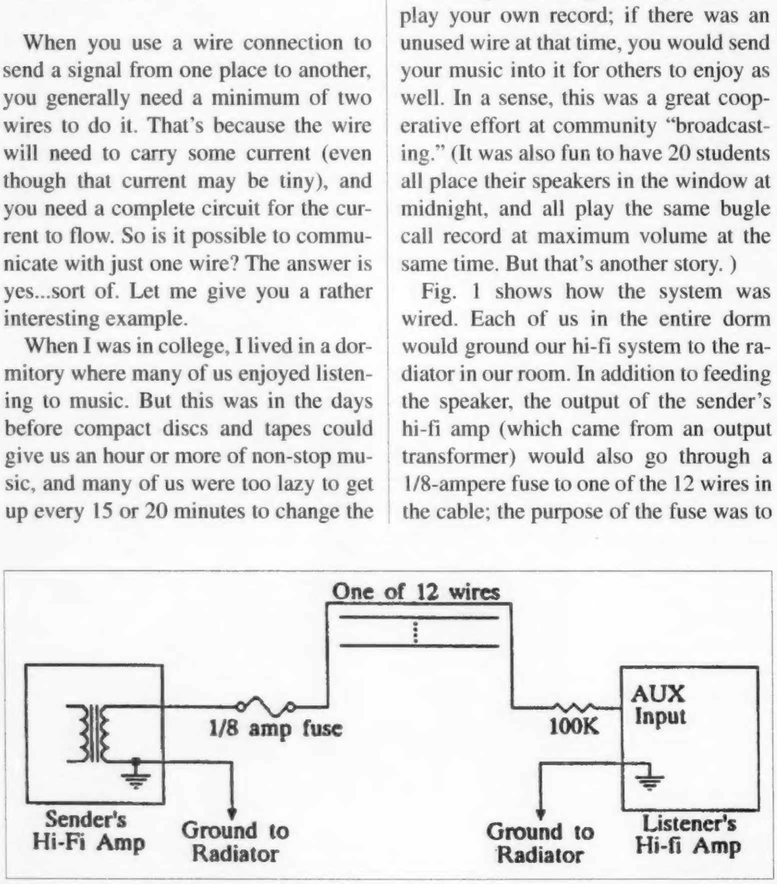

Fig. 1. College dorm music wiring system.

The system worked very well. Some of us connected to the cable with clipleads, others of us had elaborate switching systems so we could scan or feed the wires just by flipping a switch. But let's look at the system more closely.

First, although this system could be advertised as using only one wire to carry the signal, that's not true. There is another connection that is not so obvious—the ground connection through the radiator pipes. We really had a two-wire system, with the water pipes being one of the two wires. Although we had six buildings tied into the cable, they were all close to each other and all shared the same heating system, so their radiators were all connected together somewhere.

Had the buildings been farther apart, the system might not have worked as well. Although all the radiator and water pipes were eventually grounded (by being connected to some intake pipe buried underground), the earth is not a perfect conductor. (Incidentally, don't count on plumbing being grounded these days—there are enough PVC and other plastic pipes being used that there may not be a connection to ground.) Moreover, there are often other currents flowing in the earth (due to defects or improper power wiring, etc.) which would have caused the grounds in different buildings to be at slightly different voltages. These voltages would have been added to the audio signal, and most likely would have caused hum.

Then too, the 12-wire cable was hundreds of feet long, and snaked on ledges around the building, through hallways and ceilings, and through basement tunnels. Any time you have such a long wire hanging anywhere, it acts as an antenna and picks up all sorts of signals. Why was this not a problem?

The answer lay in the way each sender's amplifier was connected to the wire. Note that the audio did not come from a preamplifier output or tape output jack—it came straight from the speaker output. An audio amplifier's speaker output has a very low resistance—typically about 1 ohm—and is designed to drive a low-impedance speaker. If the wire picks up noise or hum, the amplifier is strong enough to overcome that and force the line voltage to be whatever the amp wants, not what the noise or hum source wants. In a sense, the sender's amplifier acted as a short on the line, forcing the line to its own voltage and preventing anyone else from affecting it. (For the purists among our readers, the fuse added some extra resistance, but not enough to affect the operation.)

"The test current just keeps going forever (at almost the speed of light), searching for a resistor that isn't there."

Because of the low-resistance character of the output and wire, it was possible for many students to connect their 100k-ohm resistors to the line at the same time without loading down the line and causing the voltage to drop. As someone connected to the line or disconnected from it, none of us would hear any clicks or volume changes. This kind of a connection, where a high-resistance load is connected to a low-resistance line without any interference is called *bridging*.

Had the output come from a preamp or tape output jack or other "line-level" source, the line would have picked up so much noise and hum that it would have been impossible to use it without some changes.

Shielded wire

One way to prevent an audio signal from picking up interference and hum is to shield it. For example, all the audio cable commonly used between phonographs, tape recorders, and other home hi-fi components (except speakers) is normally shielded wire, such as shown in Fig. 2.

The shield serves three purposes: it prevents outside interference from getting to the inner wire (which carries the actual signal), it prevents the signal from leaking out and affecting other nearby circuits, and it also serves as the second or ground wire, needed to complete the circuit so current can flow.

Shielded wire is used for many purposes, from carrying audio signals to carrying radio frequency (RF) or microwave signals; in the latter case, it is often called *coax* or *coaxial cable*, rather than shielded wire, but the principle is the same. Fig. 3 shows several popular connectors for audio (the RCA phono plug and the phone jack) and for radio-frequency signals (the PL-255 RF connector and the BNC connector).

When properly used, shielded or coax wire does have the advantage of not picking up or releasing stray signals. But it has some disadvantages as well, one of them being that it loses some of the signal it carries. For example, it quite often happens that the signal coming out of such a cable is only half as strong as what went in (or even weaker.) In RF applications, much of this loss is caused by the inner insulator; hence many high-quality cables use air (or even an inert gas) as the insulator, with just a thin spiral-wound strip of insulator to separate the shield from the inner conductor.

A second problem, especially in audio applications, is that the shield is so close to the center conductor that there is appreciable capacitance between the two. This tends to short out higher frequencies, so that the cable does not carry high-frequency signals as well as it does low-frequency ones. This reduction of treble response means that this kind of cable is seldom used in lengths over several hundred feet.

A third problem exists in long-distance audio circuits due to the presence of the grounded shield. Audio equipment often has three-wire AC plugs, which ground the cabinet of the equipment through the AC power system. When two pieces of equipment are located some distance apart, these grounds are not directly connected together, and so the cabinets of these two devices may be at a slightly different voltage. When a shielded wire is run between the two, the shield is a second connection between the two cabinets; because of the slight voltage differences, a small 60-Hz AC current flows through the shield and causes a voltage drop. Even though this voltage drop may be just a tiny fraction of a volt, this may not be much smaller than the audio voltage in the cable. This voltage along the shield is then added to the audio signal in the cable, and appears as a hum signal.

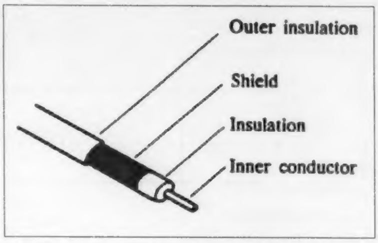

Fig. 2. Construction of a shielded wire.

This isn't much of a problem in a home hi-fi installation, since most home hi-fi components are close together and usually plugged into the same outlet. But it is a major problem in recording and broadcast studios, where signals may have to travel from room to room, or even from one side of town to the other.

Balanced line

Recording and broadcast studios solve many of their wire problems by using *balanced* line, which may be shielded as well, but where shielding is often not even needed.

Fig. 4 shows how a balanced line was used before the days of modern solid-state equipment. With vacuum tubes, the connections to and from balanced lines were usually done with transformers. A center-tapped output transformer would feed the line, and another center-tapped transformer would take the signal from the line. Neither of the two wires in the line was grounded; instead, the ground was connected to the center taps of the two transformers.

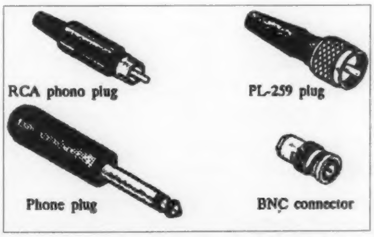

Fig. 3. Several connectors for shielded wire.

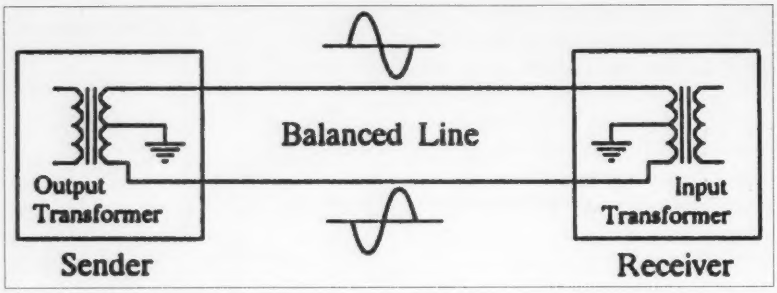

Fig. 4. A balanced audio line.

As Fig. 4 shows, the signals on the two wires are exact opposites of each other—whenever one wire goes plus, the other goes minus by the exact same amount. You can think of this as a seesaw—whenever one end of the seesaw goes up, the other end goes down by the same amount, and the center (where the hinge is—physicists would call it the fulcrum) never moves up or down. We call this type of line a balanced line because the voltages on the two wires are exactly equal (but opposite), so they cancel each other out. (The shielded or coax line, on the other hand, has the signal on the inside lead only, and is therefore called *unbalanced*.)

The input transformer on the right looks only at the difference voltage between the two wires.

Now suppose that there is some external source of electrical noise, which is picked up by the two wires. If the two wires are close enough to each other, they will pick up the same amount of noise. But if both wires pick up the same noise, this doesn't change the voltage difference between them, which means that the input transformer in the receiver doesn't see that noise at all. Shielding is therefore not always needed to keep noise and interference out of a balanced line.

The trick, of course, is to make sure that both wires pick up the noise or interference in exactly the same way. To make sure that this happens, the two wires are usually twisted together, which gives this sort of line the name *twisted pair*. (In fact, one of the favorite buzzwords in modern local area networks is UTP, which simply means unshielded twisted pair.) Sometimes it's interesting to look at some old telephone poles out in the country (or along an old railroad track) and see how they arranged the twisted pair in the old days—see Fig. 5.

There are, of course, some cases where shielding is used in addition to the balanced line. Although the use of a two-wire balanced system cancels out noise and hum, it is not perfect. If the signal is small enough, the noise and hum might still be significant. Thus the microphone cables in recording and broadcast studios are always both shielded and balanced. (Microphone cables in home-type equipment are generally shielded but unbalanced. That's because home-type microphones generally have short cables, whereas professional mikes might be used with very long cables.)

Characteristic impedance

We will look at characteristic impedance in greater detail later, so we will just do it "once over lightly" right now. Think for a moment about how an ohmmeter works. Inside every ohmmeter is a small battery. When you connect the ohmmeter across a resistor, the meter connects that battery across the resistor. Current starts to flow through the resistor, the meter measures how much current there is, and computes the resistance from Ohm's Law:

$$\text{resistance} = \frac{\text{voltage across resistor}}{\text{current through it}}$$

A digital meter computes the resistance in some integrated circuits; an analog meter does it by properly calibrating the meter scale.

Now, imagine (you need a big imagination for this!) that you have an infinitely long length of some cable, such as the flat twin-lead cable used for TV antennas, and you connect the ohmmeter between the two wires at your end. What will you measure?

When you first think about this, you may think that you will measure an infinite resistance—an open circuit. After all, the two wires never touch, so there is no connection between them and therefore no current can flow, right?

Wrong. Connecting the ohmmeter to the end of your cable connects its battery across the two wires. The ohmmeter of course doesn't know whether there is an inch, a foot, or a mile of wire there, so it sends some current out its test leads, hoping eventually to reach a resistor at the end. Normally, the current would reach a resistor after going through just a few feet of wire, and settle down to whatever current Ohm's Law wants. In this case, however, that test current just keeps going forever (at almost the speed of light), searching for a resistor that isn't there. The ohmmeter, however, doesn't know that this test current never reached a resistor; it happily measures the current and voltage, and displays a value of resistance anyway.

The amount of current that flows depends on the kind of cable. Actually, its resistance has fairly little to do with it; it's the capacitance between the two wires, and the inductance of the wires, that mainly determine how much current flows down the cable. The resistance the meter measures therefore depends on the type of cable; we call it Z_0, or the characteristic impedance of the cable.

Different cables have different characteristic impedances—the TV twin-lead is 300 ohms, the coaxial cable used for TV antennas is 75 ohms, while the coax generally used for transmitting antennas is 50 ohms. And the twisted-pair cable generally used for audio and telephone circuits would measure 600 ohms.

Since actually measuring the Z_0 with an ohmmeter requires an infinitely long length of cable, it's not a very practical procedure. But even in shorter lengths, knowing the Z_0 is important because it affects what happens when the cable is connected to a load.

As mentioned above, when we connect an ohmmeter to the end of a cable, the meter sends a test voltage and current down the cable. If the cable were really infinitely long, that current would continue forever. But suppose you cut the cable after some distance, and connect some resistor across the cut end—what happens to that test current when it gets to the resistor?

If the resistor just happens to equal the Z_0 of the cable, then the test voltage and current just flow through the resistor, and that's the end of the story. The ohmmeter continues indicating the value of Z_0, which is what you'd expect, and that's it.

But suppose the resistor is not equal to Z_0—it is either larger or smaller. Then the test current and voltage eventually hit the resistor, but their values are wrong. From Ohm's Law, the current and voltage would be perfect for a value of Z_0, but the resistance is different and so something has to change. A strange thing now happens—some of the voltage and current bounce off the resistor and start to travel backward on the cable. The resistor is reflecting the voltage and current, and telling the ohmmeter, "Hey, you sent me the wrong values of current and voltage—try again!"

This sort of reflection will always happen if the load at the end of the cable is different from the Z_0 of the cable. This is why engineers often say, "Make sure to terminate (end) the cable in its characteristic impedance." This is the only way to avoid reflections.

DETOUR

Another way to state this is "If the line is more than about 1/100 wavelength long, it should be terminated if you don't want reflections."

The distance a signal travels in the time for one cycle is called a wavelength, and is equal to

$$\text{wavelength} = \frac{\text{speed of the signal}}{\text{frequency of the signal}}$$

The symbol for wavelength is the Greek letter λ. So lines longer than about 1/100 λ can cause problems.

Electric signals in cables travel at somewhere between 65% and 95% of the speed of light, depending on the cable, so about 150,000 miles per second makes a good approximation. If you consider a telephone line carrying audio up to about 3500 Hz, the wavelength is

$$\lambda = \frac{150{,}000 \text{ miles per second}}{3500 \text{ Hz}}$$

which is about 42 miles. So a line longer than about 42/100 miles, or about 0.4 miles, should be terminated. If, on the other hand, the frequency was 100 MHz, then anything longer than a few inches should be terminated.

END OF DETOUR

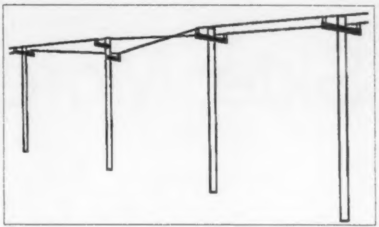

Fig. 5. An old twisted-pair telephone line.

But note that if the cable is short, the reflection may occur so soon that it does not interfere with the original signal. What do we mean by "short"? That depends on the frequencies that are used.

For instance, suppose the signal being carried is a simple 1-volt peak, 1-Hz sine wave signal; that is, a signal which starts at 0 volts, takes 1/4 second to get to its peak of +1 volt, another 1/4 second to get back to 0 volts, another 1/4 second to go to -1 volt, and then 1/4 second to return back to 0 volts. And suppose it takes 1/2 second for the signal to go to the end and the reflection to return to the beginning. Then, just as the +1-volt peak comes reflected back, the input is at -1 volt. The +1-volt reflection and the -1-volt outgoing signal will then fight each other, and this will cause a problem. On the other hand, if the reflection took only 1/1000 second to return, then the outgoing signal would still be pretty much the same, and the reflected signal would not interfere as much. But if the signal was at 500 Hz, then the 1/1000 second delay for the reflection would come at just the wrong time, and there would again be a problem.

The basic rule of thumb is that, if the round-trip time for the signal to get to the end and come back as a reflection is more than a small fraction—1/50 or so would be a rough approximation—of the time for one cycle, reflections can be a problem, and then the line must be properly terminated to stop the reflections. This means that if the one-way time for a signal to get from one end to the other is more than about 1/100 of the time for one cycle, reflections can be a problem, and then the line should be terminated with a resistance equal to its characteristic impedance Z_0.

So let us next discuss the types of cables normally used in communications.

Audio Equipment

Home audio equipment uses plain shielded wire, except to connect the speaker, where the signal is so big that noise pickup is not a problem. Likewise, most cables are short enough that terminating the cables is not important.

Years ago, professional recording and broadcast studio equipment used 600-ohm balanced cables almost exclusively (except for 50-ohm cables for microphones, and unshielded wires for speaker connections.) Broadcast stations still tend to stick with 600-ohm balanced cables, partially because they still use old equipment, but also because they need the benefits of balanced cables. Not only do they tend to send signals longer distances, but many stations also place their studios close to their transmitters, and have the additional problem of having to keep the high-power transmitted signals out of their audio circuits.

But recording studios have gotten somewhat lax about it. There are two reasons for this. One is that the best way to get a balanced line is with a transformer; but recording studios try to stay away from transformers because they degrade the audio quality slightly. The second reason is that there are many small-time studios which operate on a budget; unbalanced equipment and connections are cheaper, especially since home equipment has gotten so good that many studios use a mixture of professional and home equipment. 73

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The Tech Side: More Adapters

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Peterborough NH 03458

Last time, in *Radio Fun*, we were exploring the subject of AC adapters, and looking at how you mate an adapter to an unrelated gadget. Let's continue:

Voltage and current

You've ascertained the proper polarity, and now it's time to deal with the voltage issue. Can't you just match the voltage stated on the adapter to the device's required voltage and be done with it? Sometimes that works fine. Other times, though, you can wind up with problems.

Let's say you have a 6 volt device. How can you be sure it takes 6 volts? Usually, the required voltage will be stated on the case, next to the DC input jack, or it may be on the back, somewhere near the battery door. If there is no marking, count the number of batteries and multiply by each battery's voltage. So, if the device takes four AA cells, you know that's 6 volts because 4 times 1.5 (an AA cell's voltage) equals 6.

Occasionally, you may run into something that requires a higher voltage at the DC input jack than would be given by the number of batteries the gadget uses. I've seen some products that operate from 6 volts' worth of batteries but take 9 volts at the input jack. (Although I've never seen it the other way around, I suppose it is possible.) In most cases, such a device will still work on the lower voltage, but not always. Knowing this, however, is *not* a license to try higher voltages if your hookup refuses to work. Excess voltage can quickly ruin your device! Usually, failure is due to other problems, anyway. But, if you can't get the AC adapter to work, and you've tried all the techniques I'll be describing here, then try and get some service data on the equipment from the manufacturer or others who own the same product, to be sure of the input requirements. Don't just crank up the voltage and keep trying, or you may very well be sorry. There's nothing like that sinking feeling when the unit's lights go out and the first wisp of smoke appears. Remember, electronic circuits operate on smoke; once you let it out, they don't work anymore!

Assuming that you *do* know the correct voltage, here's where the fun begins. Logic would suggest that you could simply match the voltage with the one printed on the adapter, verify the polarity and plug it in. Logic would be wrong. The problem with this scenario is that the printed voltage on the adapter isn't a constant. Almost all AC wall cubes are unregulated. That is, they don't really produce their stated voltage except when at their rated current load. So, if your adapter is rated to deliver 6 volts at 700 mA (milliamps), it may deliver 8 or even 10 volts at significantly lesser load. While you don't need to get the input voltage exactly right, being 50 percent too high is asking for trouble! And, being too low by such a significant amount will probably cause the unit to malfunction, if it'll work at all. In order to get it all working right, you need to know the approximate current demand of your device. Chances are, that value will *not* be printed on the case!

Test it

There are various ways around that problem. If you have a current scale on your VOM (volt-ohm-milliammeter) and a variable power supply, you can simply feed the gadget the correct voltage and measure its current draw. Remember, the meter's leads go in series with the power supply, not in parallel across it. Although it usually won't matter which lead you choose to interrupt for your current measurement, use the ungrounded one, usually the positive, to be sure you don't cause a ground loop (an unwanted flow through an alternate path), which could confuse your reading and, in rare circumstances, even cause damage to your device.

If your shop is not so blessed with gear, there are some other things you can try. Take an adapter rated for the required voltage, with the smallest current capability you can find. Hook it up and try it, remembering to observe the polarity. Most likely, it won't put out too much voltage; it'll probably be too low. If the device works fine, you're home free, as long as the adapter doesn't seem to be heating up a great deal. If, though, it exhibits AC hum or seems weak in some way, it has given you a valuable piece of information: Your device requires more current than this adapter can deliver! Make a note of the adapter's current rating and try another one, this time with a higher current capacity.

Eventually, you'll get to one that works. Or, if you don't have any others, you can use your measurements to deduce how to use what you have. If, for instance, you need 9 volts but have only 7.5 volt adapters, try using one with a fairly high current rating. That way, it may put out something around the 9 volts you need, because it can supply more current than is required, raising its voltage above the rating.

Going the other way, though, is asking for trouble. *Don't* use a 9 volt adapter with a small current rating to power a 6 volt device, with the idea that the excess current demand will lower the adapter's voltage. It will, but it'll also cause AC hum and, more seriously, heat up the

Continued on page 75

Welcome Newcomers!

Wayne Green W2NSD/1

With the facts of life telling me that around 95% of ham newcomers these days are dead-ending on 2m, maybe you can give me an idea of how to get them excited enough to upgrade and join us old timers down on the DC bands. I've tried pointing to the adventures that hamming has provided for me. "Oh, there goes old Wayne blowing his horn again."

On the other hand, if the spirit of adventure has either been blown out, or has never been kindled in their minds, I'm wasting both my time and theirs. Almost anyone can learn the stupid code and get the Advanced Class ticket and enjoy everything hamming has to offer.

Yes, of course it takes money to go on DXpeditions, but if you have a spirit of adventure and the ability to work for a goal, making money is a snap. It's this spirit that gets a treasured few hams to be active on our satellites, helping packet grow and speed up, winning contests, and so on. It's the spirit that gets people to read and learn. It's this spirit, according to Ray Kroc, the chap who gave us McDonald's, that determines winners and losers in life.

I've spent a lot of time up here on my soapbox, waving my arms and trying to get hams to take advantage of the world of adventure hamming provides. Eyes glaze over. Yawns. I want to get as many people to share the excitement and adventures I've experienced, so I talk at conventions and write about the things that have helped make my life so interesting. The fun of hearing your voice come back from a ham satellite, delayed a little by the distance. The thrill of downhill skiing when you're good at it. The indescribable feeling of scuba diving on a coral reef. The exhilaration of beating down a pileup from some weird country. The feeling of making a 10 GHz contact in another state while freezing your fingers on top of a mountain. The joy of hearing ragtime piano played by an expert. The rapture of reading a book and learning something new.

These are feelings that movies and TV can't evoke. Oh, there have been a few darned good movies, but even the best don't compare with the feeling you get from working country number 330 or making that slow scan contact with the Canary Islands. Or an aurora contact on 2m a thousand miles away. Or a moonbounce contact with VK3ATN or HB9RF.

The code? Sure, let's keep plugging at getting rid of that obstacle, but in the meanwhile stop using it as an excuse. Yes, I know, you have dyslexia or some other stupid excuse. Just shut up and use my method to learn the code. If you're too cheap to buy my code tapes, then get a program for your computer that will send the code at 13 or 20 per and save the $7.

No, I'm not at all in favor of lowering the standards, just in getting rid of an artificial barrier which these days has nothing to do with technology. This is a high-tech hobby. We should be using it as a gateway for kids to get started learning the fundamentals of electronics and communications. The 21st century is going to be unforgiving of people who are not high-tech literate. And what more fun way to learn than by amateur radio?

In the past all of the major discoveries and pioneering in radio communications was done by amateurs. We pretty much stopped doing that 30 years ago, thereby abrogating the lease requirements for our ham frequencies. Fortunately our landlord hasn't noticed that we've stopped paying the rent. But the increased pressure from commercial interests who want our bands may eventually get through. Money talks, and we're beggars, living on past glories.

1200 baud packet? Give me a break! 28,800 baud is getting to be the standard on the Internet and 56k is coming along fast. So what have you done to help get us up to speed? Yes, I know, you have an HT on your belt. Well, I did that back in 1969. Heck, I had my own repeater on Pack Monadnock Mountain in 1969, providing contacts over almost all of New England. And that's almost 30 years ago. More than a generation.

If you put your mind to it you could be an expert on packet in a few days. Weeks, at the worst. If they can cram 56k baud over a crummy phone line, you should be able to zip it over the air without dropping a baud, and never mind tropospheric multi-path distortion.

Quiz: how many words per minute are 56k bauds? Now where's my trusty old hand key? With some decent baudy work a DXpedition could flatten a pileup in seconds.

I've done some research that you haven't bothered to yet, so I know how to cure almost every human illness and to live to 120 or so in good health, so if by some magic we manage to hold on to some ham bands, I expect to be one of the pioneers who helps us develop a system where we'll be able to work every licensed ham in the Callbook in one day. And they'll all be reachable, too. Or at least their stations will be.

I've been writing about health in my editorials. How about an antibiotic which microbes can't mutate to avoid? One that you can make at home for fractions of a cent? The medical industry is going to go bananas if word of this gets out.

How about a cure for any blood-carried illness that costs pennies to use? One that'll wipe out any virus, bacteria, fungus, or parasite in the blood? I'll be writing more about all that. You'll still be able to fall off your tower or get across the final plate voltage and expire, but it won't be the slow, lingering death most people are suffering.

Well, that's just one of my recent interests. I'll tell you more about all that on 20m, or if I get invited (all expenses paid) to talk at a hamfest near you. Yes, of course I'll talk about amateur radio too. 73

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Radio Magic

by Michael Bryce WB8VGE

Troubleshooting Your New Kit

What do you do when the darned thing doesn't work?

Still can't find out what is wrong with your new kit? Often another person can spot something you have been passing over. However, if even that doesn't work, then let's dig out the test gear and see what we can find. Here's the drill. Say the project is not entirely dead, but just not working like it should be. Really "dead" kits are usually easy to fix.

The first place to check is the power source. It may be as simple as a 9 volt battery, or as complex as a switching-regulator supply. Let's check to see if there is voltage coming out of the source and if that voltage is enough to operate the unit. A digital VOM comes in real handy here. If you don't have one in your tool box, it's time you did.

Attach the black lead of your VOM to the ground side of your unit with a clip lead. Radio Shack™ carries a nice selection of clip leads, so pick up a bag or two. The ground is normally the negative side of the battery/power supply or the common ground bus around the PC board.

Now, with your VOM's positive probe, touch the positive side of the battery or power source. Let's use our example of a 9 volt battery. Your VOM should read at least 8 volts or higher with a fresh battery. Now, turn your kit on. Did the battery voltage drop way down to, say, 5 or 7 volts? It did? Well then, either you need a fresher battery, or you need to take a closer look at the current flowing to the unit. To do this we need to switch our VOM to display current and insert the VOM in *series* between the battery and our kit. This is simple to do when you're using clip leads. As our project is running from a 9 volt battery, it's easy to snap off one battery clip and give it a slight turn to expose the now bare battery terminal. It makes no difference which battery terminal we use—the digital VOM will read the current either way. If we connect the VOM up backwards it will display a "-" to the left of the display. This of course only works with a digital VOM and not the older analog types.

> **"Even with the simplest test gear, we have been able to determine several causes and their fixes."**

Attach one clip to the bare battery terminal and another to the battery clip. Select current with the VOM switch and then select the proper current range. Since this device is running from a 9 volt battery, select one of the lower current ranges. It is good practice to select the highest current range and then reduce the setting until a valid reading is obtained. A 500 to 200 mA range is a good start. It's only a 9 volt battery, so your unit shouldn't draw a lot of current.

Turn on the power switch and note the current being drawn on the VOM's display. Hmm, the meter reads 80 mA, so now we can see why the voltage dropped. That's a lot of juice for a single 9 volt battery. They are designed for loads of just a few mAs to maybe 20 mA on the high end. But 80 mA? Nah, that's way too much current. And that means you have something drawing all this current. All you have to do is find what's doing it. You've got about a 112 ohm resistance from B+ to ground in there somewhere instead of 450 ohms or more.

Some possible causes are a shorted output device, audio amp, or RF amplifier; electrolytic capacitor(s) installed backwards; leaky electrolytic capacitor(s); IC chip(s) installed backwards or in the wrong location; the voltage regulator installed backwards or in wrong location; a solder bridge between two or more PC traces; or even the battery installed backwards.

Or let's say we measured the battery voltage and it did not change when we turned on the unit. We connected our VOM to read current and the current displayed was zero. So what's wrong? There must be a break in *series* with the supply. Let's look for some possible causes such as a broken battery connector, a reverse-polarity protection diode installed backwards, a bad battery wire solder junction to the PC board, a solder flux insulator around the plus supply wire on PC board, a defective crimp on connector, or the battery connected backwards.

Of course, in both cases, it is possible to have another problem causing either excessive current or no current. But check out these quick fixes first.

When there's excessive current flowing, there is a good chance you can feel for the defective part. Even at only 60 mA, something is going to get warm. So, with your fingertip, carefully touch each part to see if it is running warm or even hot. *Don't do this test with any piece of gear running from a 110 volt supply or one with high-voltage circuits inside.*

If you come by a component that is hot to the touch, then turn off the project and take a closer look at that section. Remember, the hot part may not be the fault. It may be running hot because of something else down the road.

It's very easy to swap a small three-terminal voltage regulator with a transistor. They look the same, but are hardly interchangeable! If this fate befalls you, then you can bet the farm that the regulator is cooked. Luckily, they're not very expensive. You have to remove the one already installed backwards, so you may as well replace it with a brand-new device. The lesson here is: If you hook up a solid state device backwards or install it incorrectly, it's more than likely bad. Just replace it and put the whole mess down to experience!

The above examples point to two fundamental facts about current and voltage. Even with the simplest test gear, we have been able to determine several causes and their fixes. 73

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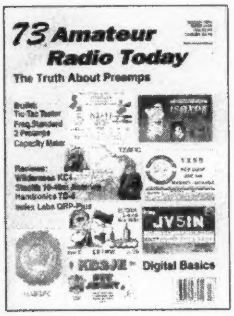

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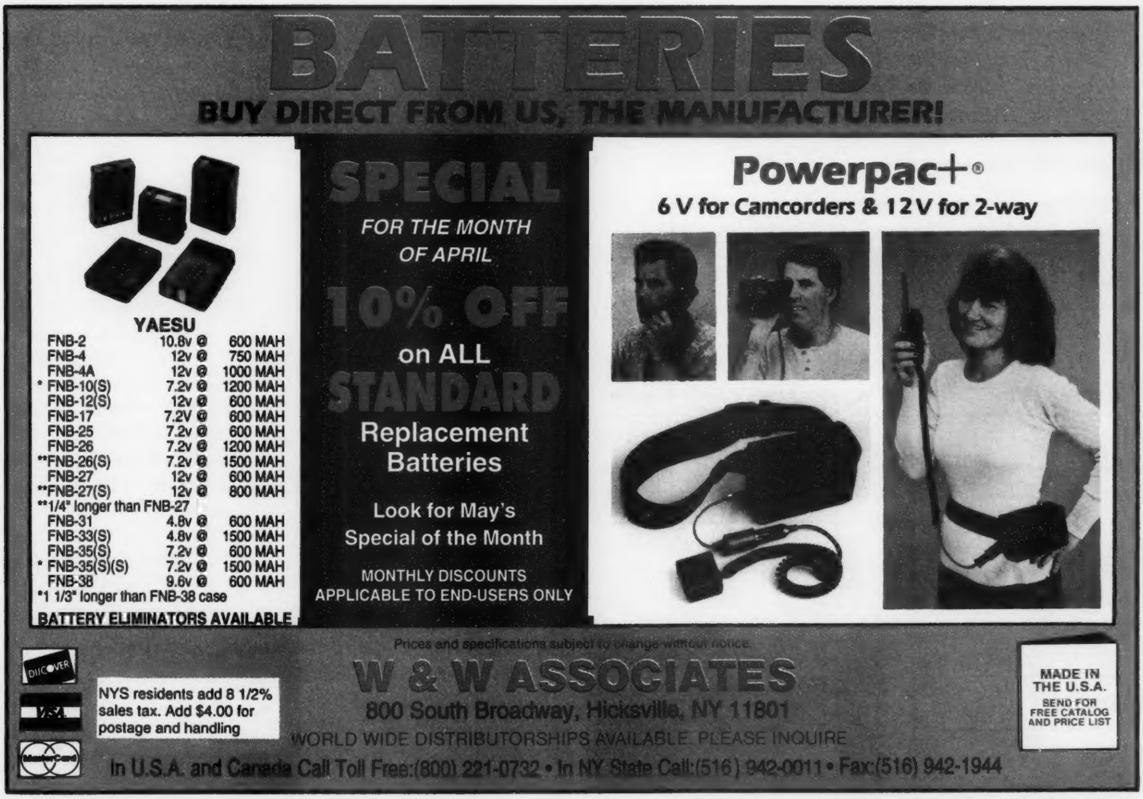

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Amateur Radio Via Satellites

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When OSCAR-1 was launched nearly 35 years ago, amateur radio operators didn't have computers for orbit predictions. The chore was attacked with slide rules and pencils. With a few pieces of information, it was possible to predict when the satellite would be within range, but the process was tedious.

During the next decade special maps and clear overlays were used to predict satellite positions. Using an OSCAR-LOCATOR kit and a few simple pieces of data (equator crossing time and longitude of crossing), tracking was relatively easy and inexpensive.

The late 1970s and early 1980s marked the arrival of the home computer for satellite pursuits. While many new owners of Radio Shack TRS-80s and early Apple computers were wondering what to do with their new and expensive toys, hams were tracking satellites with ease and incredible accuracy. Even Sinclair ZX-81 fans could plot the paths of complex orbits.

Today's PCs make satellite tracking a simple task. Many software packages exist that not only predict access times, but provide real-time simultaneous tracking of many satellites with graphical earth views and automatic antenna pointing. Most ham radio BBSs and ham-oriented Internet sites (try ftp.amsat.org or http://www.amsat.org) have some shareware and freeware programs that will do the job.

The numbers

One thing that all satellite tracking methods have in common is the need for orbital data to characterize a particular satellite's position in space at a given time. This data is commonly referred to as "Keplerian elements" or just "element sets."

Due to atmospheric drag and other effects and inaccuracies that accumulate with time, new element sets are needed to maintain the prediction accuracy of the software. Some satellites with high, stable orbits may only need new data once a year, while other low orbit objects with changing orbits, like the MIR space station, could use a new set every week.

Table 1 shows an element set for AMSAT-OSCAR-13 presented in standard "AMSAT" format. Many satellite enthusiasts get element sets for all the satellites they wish to track from packet radio, BBSs or the Internet, usually the same sites where tracking software is found. The element sets are in a standard text file that can be placed in the same directory as the tracking program. The program typically has a menu choice allowing automatic updating of its satellite database from the element-set file.

With such an effortless process to get new data running, it's understandable that many users are not aware of the meaning of the numbers. It's not necessary to have a degree in mathematics to work with element sets, but some knowledge of their significance is useful. Sometimes blatantly bad element sets are released, or satellites are given the wrong identifier shortly after launch. A quick look at the element set may reveal a ridiculous Decay rate or impossible Mean motion.

The set in Table 1 describes an orbit that is elliptical with a high apogee occurring over the northern hemisphere. There is very little atmospheric drag and the time to make one orbit is just under 12 hours. A description of the individual elements can explain these quick observations and more.

Catalog number	1	9	2	1	6										
Epoch time		9	6	0	1	1	.	3	8	4	7	5	8	4	0
Element set		1	3	4											
Inclination				5	7	.	4	0	2	9	d	e	g		
RA of node			1	4	1	.	8	2	2	7	d	e	g		
Eccentricity		0	.	7	3	6	6	0	4	3					
Arg of perigee				2	8	.	7	6	0	7	d	e	g		
Mean anomaly			3	5	6	.	7	5	8	7	d	e	g		
Mean motion	2	.	0	9	7	3	1	2	5	1	/	d	a	y	
Decay rate		-	4	.	4	4	e	-	0	6	/	d	a	y	^{2}
Epoch rev							5	8	0	1					
Checksum								3	0	6					

Table 1. AMSAT-format Satellite AO-13 element set.

Satellite:

The first entry is an informal name that is distinct to this satellite. AO-13 is also known as A-O-13 or AMSAT-OSCAR 13. The "OSCAR" part of the name dates back to the first ham radio satellite, OSCAR-1, and stands for Orbiting Satellite Carrying Amateur Radio.

Catalog number:

NASA assigns formal identification numbers to all man-made orbiting objects. Vanguard 1, launched on March 17, 1958, is still in orbit and has Catalog number 5. AO-13 was launched on June 15, 1988 and is listed as Catalog number 19216. The Catalog number should not be confused with the International Designation number which specifies year of launch, launch number since the beginning of the year and object letter identifier. AO-13's "ID" is 1988-051B.

Epoch time:

Note the example in Table 1. The Epoch time is 96011.38475840, defining the moment when all of the numbers in the element set were measured or derived. This corresponds to year 1996, day 11, followed by the "decimal day" of 0.38475840. Using the fact that there are 24 hours in a day, 60 minutes in an hour and 60 seconds in a minute, the "normal" time format can be found as 9 hours, 14 minutes and 3.126 seconds. Thus 96011.38475840 is the same as January 14, 1996, at 9:14:03 UTC. UTC stands for Universal Coordinated Time. If you are not already logging your ham activities in UTC (same as GMT), working with satellites will provide the needed boost. All satellite predictions use UTC. Conversion to local time zones is a feature incorporated in most software.

Element set:

This entry identifies the element set. Set number 134 is obviously more recent than set

130. Sometimes the set number may include other clues as to its origin. James Miller G3RUH has been releasing "smoothed" element sets for AO-13 and AO-10 that represent averages of several NORAD/NASA sets. The G3RUH sets' accuracy over time is better than the NORAD/NASA sets' and have names like RUH8-95, for a G3RUH set done in August 1995. Space Shuttle sets may also have letters in with the numbers, depending on their origin.

Inclination:

The inclination of a satellite's orbit is the angle of the path of the orbit as it crosses the equator of the earth while moving south to north. A polar orbit that travels from pole to pole will have an inclination near 90°, while a satellite that follows the equator will have an inclination near zero.

RA of node:

The RA of node or RAAN is the Right Ascension of Ascending Node. This element is one of the most difficult to understand. A simple definition describes RAAN as an angle that specifies the orientation of a satellite's orbital plane with respect to the fixed stars. The satellite's orbital plane is relatively easy to visualize. The difficult part is to envision the creation of an angle between this orbital plane and the "fixed stars." In the case of the NASA element sets, the line to the "stars" is drawn from the center of the earth to a star in the constellation Aries. The angle defined by the intersection of this line and the satellite's orbital plane at the time of the Epoch is the RA of node.

Eccentricity:

The Eccentricity term refers to the shape of the orbit. No orbit is exactly circular. If it were, this element would have a value of zero. The Eccentricity of AO-13 for the element set in Table 1 is 0.7366043. This shows that the orbit is highly elliptical. Due to the influence of the moon, AO-13's orbit is becoming more elliptical every day. Most tracking programs cannot predict this change due to their inability to handle gravitational forces beyond the earth-satellite interaction. For most ham pursuits, this is not a serious problem, except when a satellite crashes to the earth, like AO-13 will, in December of this year. Updating the element sets each month until the end will at least provide accurate tracking predictions for making contacts and enjoying this orbiting resource as long as possible.

Arg of perigee:

The Argument of perigee is another "difficult" element. It describes where the perigee (or low point) of the orbit is located in the satellite's orbital plane. If the perigee occurs when the satellite is crossing the equator on a south-to-north pass, the angle from the equator to the perigee point is obviously zero (they are occurring at the same place), therefore the Argument of perigee would be zero. The apogee, or high point of the orbit, would occur 180° (half an orbit) later, also on the equator.

For the example in Table 1, we have an Argument of perigee of 28.7607°. This means that AO-13's perigee is occurring 28.7607° after crossing the equator while headed north. The apogee is thus occurring below the equator, half an orbit later.

Mean anomaly:

Mean anomaly locates the satellite in its orbital plane at the time of the epoch. All programs use standard astronomical convention for this element. The satellite is at 0° or 360° at perigee and 180° at apogee. In our example the value of 356.7587° is very near perigee for AO-13 at the Epoch time noted.

Mean motion:

This element simply specifies the number of orbits (perigee to perigee) the satellite makes in one solar day (1440 minutes). In the example, AO-13 is making slightly more than two orbits per day, thus each orbit is a little less than 12 hours.

Decay rate:

The Decay rate of a satellite's orbit is also defined as the rate of change of Mean motion, the first derivative of Mean motion, or as the drag factor. It provides a correction to the Mean motion that accumulates with time after the Epoch of the element set. Satellites with high orbits have very little orbital decay, while objects like the Space Shuttle or MIR have significant values associated with this element due to their low orbits and corresponding atmospheric drag. The Decay rate in the example is a very small negative number shown in scientific notation. The -4.44e-06 value can also be written as - 0.00000444 rev/day/day (orbits per day squared). The negative value in this element set for Decay rate is not typical but may be a result of gravity pumping or caused by the method of data collection by NORAD.

Epoch rev:

This is the orbit number. While satellite enthusiasts used to keep close accounting of orbit numbers for QSL cards and logs, this is no longer the case. In many instances, the orbit number shown in the NORAD/NASA element sets will differ from calculated values. Differences occur due to the definition of orbit number 1, or is it orbit number 0? The question of when the orbit increments also comes up. Do we increase the count by one when the satellite passes through perigee or when it crosses the equator on a south-to-north pass?

Checksum:

This is simply a math function to verify the validity of the numbers in the element set. It is the total of all the individual digits in the set. Some programs use the checksum. If the checksum value and the total of the digits match, the element set is assumed to be correct, at least the data is assumed to be the same as when it was first calculated.

The Tech Side: More

Continued from page 70

adapter, possibly to the failure or meltdown point! It's normal for AC wall cubes to get warm with use, but they shouldn't get hot. Lots of heat is a dead giveaway that you're trying to pull too much current from an underrated adapter.

Wrap it up

Once you've matched the current capacity of the adapter to the device you want to power, you should be all set. Connect it up (don't forget that polarity!) and it ought to work fine. While it's running, measure the voltage across the DC plug; it should be within a volt or so of what the product needs. I prefer to err on the low side, because of the lessened chance for harming my gadget, but, as long as you're close, you should be OK. Remember, the original adapter probably wasn't any closer! I've taken measurements on plenty of circuits, and I've seen many original-equipment adapters off by as much as two volts. As far as I'm concerned, though, that's a lot, especially if it's on the high side.

I hope you've enjoyed this look at AC adapters. If you're at all like me, you'll use this information often; I can't count the number of AC adapters I've rigged up. With this in mind, look around at the next hamfest for cheap adapters for your junque box. I always keep a good supply, and I always wind up using them! Until next time, 73 from KB1UM.

To arrange some PR for your new products, please contact Frances at 603 924 0058.

NEVER SAY DIE

Continued from page 63

to de-license the reason-challenged hams (oops, I slipped and used the word "challenged." The last time I used the term "reason-challenged" I got angry letters from several crippled hams who went ballistic over my using the term "-challenged" and claiming that, just as they suspected, I was anti-crippled hams) as it is for them to get their license, we might be able to clean up our bands. But when we have hams who cause three years of aggravation, who force the ham clubs to go to court to get a restraining order, and then harass the repeater anyway, and to hell with the court order, it's time to see if we can get the FCC to make it easier to take ham tickets away than to give someone the death penalty.

I suppose you're going to sit and nod. Yep, Wayne's right again. Well, how about sitting down and going to work to get Part 97 changed so we can get rid of the scum, even if they can copy the code real good.

We seem to be able to get enough idiots licensed so that ring-leader jerks are able to recruit others of even lower mentality. We had a whole set of scum busy wasting 14313 for us, doing everything in their power to shorten the life of the hobby for all of us. Well, we deserve every hit we get if we're not smart enough to shut these turkeys down by ourselves, instead of going mewling to the FCC for help, which has more than enough to do without wiping our tushes for us. Hey, shouldn't our national organization be *doing* something for us?

And we seem to be able to endlessly put up with the hot air and self-promotion emanating from Maine all hours of the day and night. Can't we get him to settle for a web page? Somehow I think the pioneering spirit that founded this country got killed by our 60s school system, leaving us with almost no one who will stand up and fight for what's best for us.

I suppose the Viet Nam war did a lot of that too. In WWII we knew what we were fighting for and we all pitched in. As I've mentioned a few times, 80% of the hams joined the military.

Grumble.

Instead of wasting all that time and money with a repeater war, why not shut the darned thing down, take up some other hobby and stop screwing things up for everyone? And that goes for both the bad guys and the righteous. A pox on both your houses.

A Limbaugh limiter

Reader Louis Burkhardt N5LTP, of Los Alamos NM, suggested a product which might sell like burritos. It's something any dyed-in-the-wool ham should be able to put together. It's a radio talk show commercial filter. By the time you sift out the commercials, Rush's three hours will boil down to almost listening length. Ditto Liddy, and anyone else you're addicted to.

The hard way would be to sense the louder voice from commercials, but I suspect if you check the clock you'll find that the commercial and news breaks are fairly consistent day to day. If you time the Limbaugh breaks for one day the pattern will probably hold pretty well for months. That's how the stations carrying his program know when to run their commercials.

There's an outfit making a tape recorder to capture three hours of voice quality on one tape, but the price is high. I think it was around $200, which I'd rather spend on a 30-day pass to fly around the Caribbean. How about a circuit to cut a three hour radio talk show down to 90 minutes so I can set a C-90 cassette going and build a library of Art Bell shows? Or Laura Lee? Or anyone else that's running shows I shouldn't miss, but which you negligently have failed to let me know about.

Once you invent these, I'll bet there'll be a good market for them.

XYL maintenance

Many perfectly nice but näive women marry hams with no idea of what they are getting into. Sure, there are a few hams who can take it or leave the hobby. But many more are far more interested in amateur radio than in their marriages. Or even their families. I remember running a cover cartoon on *CQ* when I was the editor showing a ham sitting in front of many relay racks of equipment while his wife and baby were standing behind him in rags.

Sure, it was funny because it was an exaggeration. But a good part of the humor was the underlying truth of the situation. Hey, guys, try to remember that amateur radio is a hobby. It's for *fun*! You'll have a lot more support for your hobby if it isn't perceived as a competitor for your wife's affections.

Several hams I've known personally were divorced by their wives with ham radio named as the corespondent.

When's the last time you took the XYL out to dinner and a movie? Or, if you're thrifty like me, to a matinee and then dinner? Or maybe read the non-ham parts of my editorial to her? When's the last time you took her dancing? I have a secret I'm going to share with you: wives love romance, not rigs or nifty HTs. And nothing says romance like dancing.

Oh, you've forgotten how to dance? Then get a how-to-dance video, put it on, grab her and you'll soon have a very happy wife, with a sparkle in her eye and the bedroom in mind. The effect has been known to last for days. No fair doing this just before trying to get her to agree that you really should have a new rig. But after you've taken her out to a couple of dances she might bring up the new rig subject on her own.

Where do you get dance videos? I thought you'd never ask! They're one hour lessons and cost $42.95pp from Butterfly Video, Box 184, Antrim NH 03440. Call 800-43 DANCE for a catalog showing the nearly 100 different kinds of dances available. They even have some for kids. They've got 'em for rank beginners right on up to competition dancers. In this way you can romance your wife at home while you're learning, practicing when it's handy for you instead of going out to a class (which usually costs a lot more). And you can brush up when you've forgotten something.

I've several friends whose wives hate hams. None of them ever take their wives out dancing. Bet on it. Our hobby should be seen as that and not as a competitor for your wife's and kids' affections.

I recommend the Butterfly Videos because they're so outstanding, and I've seen 'em all. Kathy Blake is the teacher and she's won all sorts of prizes. But most important, she knows exactly what questions you're going to have and what problems, so she makes it simple and fun to learn.

Okay, now you can go back to your shack and find a pileup to molest.

Like to make some money?

I'm looking for a few go-getters to sell *73* subscriptions at hamfests. There are tons of hamfests, picnics, auctions, flea markets and other ham events where you could set up a table and make a few bucks on a Saturday. You should be able to pick up from $100 to $500 a Saturday. Remember, far too many hams aren't yet subscribing to *73*, and every one of 'em should be...and might, if you get after 'em.

Plus you can sell some of my books too (on commission). My list of "73 books you're crazy if you don't read" is selling like Big Macs. Well, at $3, even if they only buy one of the books I recommend, they'll get their money's worth just finding out about it. Then there's my "Declare War" book, subscriptions to *Cold Fusion*, and the booklet describing how to make a blood purifier which Bob Beck claims will not only completely cure AIDS, but also any blood-borne disease such as herpes, cause your body to get rid of excess weight with no dieting, and even regrow hair for male pattern baldness people.

The midwest territory is taken, but I could use energetic help in the Northwest, Northern and Southern California, the mountain states, the Southwest, the South, the Eastern Seaboard, and the Northeast.

There's quite a lot of interest in a $5 booklet I wrote recently as a result of requests from listeners to Art Bell's (W6OBB) talk radio show. This is "How To Make Money, A Beginner's Guide." Well, once you know the secret you can get out of the rut that 99.99% of the people are in, a rut of thinking that results in your never having very much money. It's a rut that is deeply engraved in our subconscious by our blessed school system and media. The more rich hams we have, the more clout we'll have with the FCC and congress.

I'm looking for hams who will get out there and not miss a hamfest within driving distance. Anyone want to help shake the money tree on Saturdays for me?

Falling behind

I can remember when we hams were in there first with new technologies instead of following far behind commercial developments. We hams invented FM and then NBFM. We invented practical sideband. But now the world is going digital and we're still fighting over CW.

Our telephones are going digital. Our hi-fi went digital over ten years ago. Now broadcast stations are going digital in one country after another. Blaupunkt, Grundig, Philips, Sony, Pioneer and Kenwood all either have receivers on the market or will have soon. No, no American companies.

With digital, each transmitter can broadcast five programs of CD-quality sound, plus data such as a newspaper. The conversion of AM and FM to digital will, I expect, happen faster than anyone imagines, just as we saw the LP become almost extinct overnight when the CD was introduced.

Some digital tests are being conducted in San Francisco, so we'll see how they go. The early tests in England ran circles around both AM and FM broadcasting in quality and coverage, as I reported several years ago.

There must be some readers who are working in this field who can help the rest of us come up to speed. Maybe with ideas on how we hams can start experimenting with digital voice communications. I'd like to see articles submitted for me to publish so we won't keep falling further and further behind the commercial state of the art. After all, it says in the lease for our ham bands that we're supposed to be leading in technology, not kicking and heel-dragging to stay 40 years behind the commercial world.

Meanwhile, people in Britain, Denmark and Sweden are already enjoying digital broadcasting, with France, Hungary, Australia, Netherlands, Canada and Mexico not far behind.

A dying breed?

With under half of our surviving hams (45.5% now) having better than entry level licenses, and with the majority of "hams" having no apparent interest in ever upgrading so they can work the low bands, perhaps you can understand why I've been researching more and more into ways to help us aging survivors add a few more years to our lives. The politically correct, who can go jump in the lake, can call me elitist, for feeling sorry for the 54.5% of our licensees who have isolated themselves into what is increasingly being called an HT-CB band.

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Sure 2m and repeaters are fun. But when I started promoting repeaters in 1969 I never thought that this activity would eventually dominate the hobby. My aim was to revive a dying hobby. What I hadn't recognized was that the almost complete elimination of our school radio club infrastructure by the ARRL's 1964 "Incentive Licensing" proposal to the FCC would permanently end our ability to attract youngsters into the hobby in any real numbers.

So, in between hectoring you to get the Techs to come to your club meetings and encourage them to upgrade, and getting on 2m yourself to help inculcate these new arrivals with our ham culture, I've been finding out all I can about how what's left of us can lead longer, healthier, and yes, maybe even happier lives.

As I've researched more and more about health, I've been recommending you read the most important books I've found. The more I've looked into this health thing, the more I'm convinced that if we can change some destructive eating and living habit patterns, we have the potential for living healthily to 120-150 years. But the obstacles are monumental and at times discouraging. Habits run deep. It seems like most people would rather enjoy a Big Mac now and endure years of chronic illnesses than live 75 more healthy years later on. How do you convince a 13-year old that starting a smoking habit now can lead in about 40 or 50 years to a nursing home with an oxygen bottle always at hand. How do you get people to stop drinking fluoridated tap water which may eventually turn them into Alzheimer veggies in nursing homes, not even able to recognize their own children or spouses?

If you read some of the books I'm recommending I think you'll find that every chronic illness can be attributed to either a nutritional deficiency or to our slowly poisoning ourselves one way or another. And with the average age of the General and above class licensees getting up into the 60s, unless I can convince them to break their destructive habits, we're goners. Pity, too, now that the short waves are increasingly being deserted for the microwaves and satellite communications. Pretty soon, what few are left of us will be about the only ones using the 3-30 MHz part of the spectrum. We might eventually get back our 7-8 MHz and 14-15 MHz bands. And then everything else except perhaps the WWV and CHU channels.

Of course, like the 13-year-old smoker, we're ignoring the inevitable loss of our most valuable future bands. Well, that's our legacy to the coming generations, like the national debt and the using up of coal, oil and other natural resources. Who really cares what happens to our 10 and 24 GHz bands? Our vision ends either tomorrow or next week some time, as it does with our health.

When the Bob Beck blood purifier turned out to cause people to lose weight without changing their eating habits, there was a rush to build and use these simple electrical gadgets. The key point was that then an eating habit didn't have to be changed. Yes, I agree, it takes a lot of determination to change habits.

I was a skinny kid until I got vaccinated. Then suddenly I developed a whole range of allergies and got fat. And I stayed fat until I was 50, when I finally decided to break that habit. I cut back to a 1500 calorie a day diet and took off over 85 pounds over nine months. 23 years later it's still off. I broke that damned habit. My approach was much like that used by Alcoholics Anonymous. Don't break your determination for anything. Not once. None of that "I'll eat that chocolate sundae today and diet tomorrow" crap.

Once you have discovered that under all that moss back there is a backbone, you can exercise it more. Use it to get you out every day for a couple miles of brisk walking. Use it to break away from the deadly pattern of always working for someone else. It takes real guts to break away from the protection of a weekly paycheck. Until the company downsizes and you're suddenly on your own. Then you blame everyone but yourself for the fix you're in.

Big companies downsize to get rid of older employees, replacing them with much less expensive and more flexible younger people. Or computers. Smaller companies go out of business. The steady lowering of communications and shipping costs puts you in more and more direct competition with a worker in Taiwan or Pakistan. And these competitors for your job work cheaper, and are better educated than you, since you've allowed your school system to sink to the worst in the developed world. You're unlikely to have either security or make much money working for others. But it's a powerful habit to break. I've been there, done that, so I know how it feels.

Even if you can't wean yourself from the comfort of a company paycheck, you can at least start breaking some eating habits and have a better shot at living in poverty on Social Security.

To the moon, Alice!

The hot fusion scientist welfare crowd is almost getting panicky over their lack of progress. They've wasted billions on fruitless attempts to fuse lighter weight atoms, thus generating energy. Indeed, I've published some papers in *Cold Fusion* showing that not only has there been almost no hot fusion progress, but that the future seems just as grim.

But now these poor old guys have a straw to grasp. Thanks N3RF for faxing me news of the fusion conference where they are looking hopefully to fuse deuterium with helium-3 (^{3}He) to make lithium. The only drawbacks seem to be the cost of deuterium, which ain't cheap, and the lack of ^{3}He. Hey, no problem! It turns out that there's tons of ^{3}He on the moon. So they're working on plans to ship helium back from the moon. Now that's a great Alice In Wonderland project and well worthy of our federal welfare scientists.

Yes, we do have a serious need to find a new energy source. Our fossil fuels are going to run out within a hundred years and there seems to be some small element of guilt about doing that to our grandchildren. And fission does generate some awful byproducts, for which we have no good plans other than to dump them on our grandchildren and let them worry about it.

Meanwhile, Japan has increased their national investment in cold fusion research from $7.5 to $100 million a year! Indeed, I'm getting most of my papers for *Cold Fusion* magazine from Japanese researchers. Our Department Of Energy is still doing its very best to prevent any American research in this field, while pouring billions into hot fusion research via a few chosen universities. Another testament to lobbying power on congress. When can

I get you to sign on to the new NRA? That's Never Re-elect Anyone! Please help flush that stinking Washington toilet you've let clog up.

We're doing pretty well, considering. We're on track to use up hundreds of millions of years worth of fossil fuels in around 150 years. My great-great grandfathers were alive 150 years ago. My father was around when the first cars got going. And I remember my family's Model T. It looks as if my grandchildren will see coal, oil and gas as rare, expensive resources. Wiped out in a cosmic blink of the eye.

Fluoridation - II

In my February editorial I reviewed a book on the dangers of fluoridation. Well, there's poor old Wayne, crying about the sky falling again, right? Maybe you shouldn't bet your life on it. Hey, I thought I was wrong once, but I found out that I was in error.

Yes, fluoride does help children's teeth. But what about the downside toxic effects the ingestion of this poison has, such as hardening of the arteries, increased brittleness of the bones, and the effects on the brain? A recent study from the Department of Toxicology, Forsyth Research Institute, the Department of Pediatric Dentistry, Eastman Dental Center and Veterinary Diagnostic Laboratory, Iowa State University have confirmed the public health malpractice and quackery many doctors have been concerned about for years.

The report cites Chinese scientists who found that a fluoride dose of only 3-11 parts per million (ppm) could effect the nervous system directly. This is well within the amount of fluoride millions of us are getting in our municipal water supplies. Add to that fluoride in toothpaste and mouth rinses, and in our cola drinks, commercial beverages, dietary supplements and even in everyday food.

Another Chinese study showed that fluoride affects our attention spans. American researchers had to make do with rats for their experiments, but they found that fluorides caused behavioral disruption in rats. Prenatal exposure caused cognitive thinking and drug-induced types of behavioral defects. Worse, they now suspect that fluorides, possibly in conjunction with aluminum, could be the root cause for the recent enormous increase in Alzheimer's disease. Right now about one old person in three can look forward to that horror!

The study concluded that fluoride levels acceptable to health departments and dental organizations can cause motor dysfunction, IQ deficits and learning difficulties in humans. Just what we need to add to our worst in the developed world school system and endless child debraining via television.

What to do? Avoid fluoride toothpastes, drink only certified fluoride-free bottled, or better yet, distilled water, put filters on your showers (call 800-728-2288), and get busy starting a political action group…or joining one, if you've got one already. Oh yes, one more thing, if it's too much trouble for you to avoid fluoridated water, then please stay the hell off 20m. We have far too many addled brains on there already. And, one more thing, better start looking around for the nursing home of your choice for when Alzheimer's sets in and turns you into a veggie.

If you think I'm exaggerating, look it up in Vol. 17, #2 1995, *Neurotoxicology and Teratology*. Well, at least get the book I recommended in February. If you've thrown the issue out you can send $3 for my list of "books you're crazy if you don't read."

I got tired of spending 79¢ a gallon for distilled water and bought a small still from Damark ($200). Then I lower the surface tension so my body will better absorb it with Flanagan's Crystal Energy. Wetter water. I suppose I should become a distributor for that stuff. One teaspoon per gallon of water is all it takes. Eddie Albert is using about six times as much in his drinking water and swears by it.

Whither cold fusion?

1995 was one heck of a year for the cold fusion people. In addition to cold fusion conferences in Boston (MIT), Monaco, Bombay, Tokyo, Sochi (Russia) and Molise (Italy), there were some demonstrations of cold fusion cells as a fusion conference at the University of Illinois, and another at Power Gen in Anaheim, where the heads of power companies saw their worst fears confirmed.

Cold fusion first popped up in 1989 when Professors Pons and Fleischmann of the University of Utah announced that when they passed an electric current through a lithium and deuterium electrolyte with a palladium cathode, after a while the cell started generating a whole lot more heat, by thousands of times, than could be accounted for by any known chemical reaction.

The media jumped on this new energy source with headlines.

The chemists and physicists were skeptical. Cold fusion? Ridiculous! Impossible. So they went to their labs, pulled out an old chunk of palladium from a drawer, and tried it out. Nothing happened, so they called in the reporters for their 15-minutes in the news. The fact that most of the universities checking out the cold fusion reaction had millions to lose if they lost funding for their hot fusion work I'm sure didn't affect their diligence one whit.

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The head of the DOE published a book on "Cold Fusion, The Fiasco of the Century."

Meanwhile several laboratories did confirm the P&F reaction, but they found it required a very good grade of palladium and days to weeks for the excess heat reaction to start.

Word of the successes leaked out, despite the refusal of any scientific journals to publish any submitted papers or the Patent Office to even look at patent applications. Perpetual motion rubbish.

So the work on cold fusion progressed mainly in Japan as new hydrogen energy, and in Russia, India and Italy. Pons and Fleischmann were so angry over their humiliation that, when a branch of Toyota came along and offered to build them the laboratory of their dreams anywhere in the world, they ended up with a $25m lab on the French Riviera.

The reality

How real is the dream of a non-polluting new energy source that can provide power at less than 10% the cost of fossil fuels such as coal, oil and gasoline? And what will something like this do to the world economy?

One inventor, Dr. Patterson of Sarasota (FL) came up with a new approach to cold fusion. He made microspheres of plastic and then flash coated them with palladium in order to provide a maximum of surface area per unit volume. With hundreds of these tiny spheres in a lithium solution in plain water instead of the more expensive deuterium used by P&F, in April, at the 5th International Cold Fusion Conference in Monaco, his cell was demonstrated producing up to 600% more heat out than the energy required to trigger the reaction.

By October at a University of Illinois fusion conference his demonstration was putting out over 100 watts of heat with only one watt of drive. Scientists from 35 countries checked the instrumentation.

In December, at the Power Gen conference in Anaheim, a scaled-up version of the cell was demonstrated, just in case there were any questions about whether a larger version would work. This cell generated 1,300 watts of heat with but 1.4 watts of drive! This created quite a storm and resulted in a flurry of power company subscriptions to my *Cold Fusion* magazine.

Indeed, there seem to be no major problems to scaling the system up for megawatts of power or down to power wrist-watches. But we're still just barely out of year one when it comes to practical cold fusion power.

There is a need for much more research. Experimenters will be testing various metals such as nickel, rhodium, rubidium, platinum and combinations of them. They'll be testing various electrolytes, temperatures, pressures, excitation voltages, frequencies, RF assistance at the hydrogen and other frequencies, vibration at various frequencies and so on. We're in a scientific no-man's land here, so most of the work is empirical.

The theory

In fact I've been getting more and more papers submitted for publication in *Cold Fusion* proposing explanations for why the cold fusion reaction is turning out so much anomalous heat. The physics establishment hates the whole business since it's "impossible." At first they said that everyone claiming to have produced excess heat had made stupid experimental errors. "They're all mistaken." Why? Because the current standard model for the atom doesn't permit it.

When I first got involved in all this I didn't know anything more about muons and leptons than you probably do. What I did know was that here was another new technology that needed some support to bring it from a laboratory curiosity into a new industry. So two years ago I started reading and asking endless dumb questions, just as I had done back in 1975 when the first microcomputer kit was announced. And in 1983 when the compact disc was introduced. And when I got interested in ham teletype in 1949, and then repeaters in 1969.

Hey, I haven't done anything you couldn't have done, if you'd made the effort. It has little to do with brains, and if you are using that excuse I suggest you invite yourself to a local Mensa meeting and find out how little big brains do for most people. No, it's just plain hard work. That's the prescription Edison gave when they asked him about genius. 99% perspiration and 1% inspiration.

So I've read a pile of books, but coming at the field from a new direction, I haven't been so totally tied down by the work of past geniuses, who may or may not have been right. There's something to be said for starting dumb. Since I have no ego tied up in needing to be right in this new field, I shrugged and proposed my model for the atom. In formulating my model I drew upon a new model for how the solar system evolved as proposed by Eric Lerner. This also explains to formation of galaxies, and even, on the next level of abstraction, why we have super-galaxies. I also drew on the 1908 book by Besant and Leadbeater on their clairvoyant visions of atoms.

Can I explain how an atom is made up in simple language? Of course.

We know from blowing atoms apart in super-colliders that they're made up of quarks. And quarks are made up of sub-quarks. And we know that all of this stuff has spin. Now, please picture a sub-quark made up of a small ball of energy. It probably looks something like a ball of yarn, with the energy that makes it up spinning around the ball, rising to the top, zipping down the middle in a tight vortex, out the bottom, and around maybe seven times again and fwoop down the vortex again.

These little energy balls are held together by the suction of the energy in the vortex. But this also tends to attract nearby balls of energy.

Think of quarks being made up of strings of these little spinning balls, which in turn make a larger spinning quark.

You may not have delved into physics far enough to know that scientists have had no good explanation for inertia. Nor have they had a reasonable explanation for why we have gravity. Einstein proposed gravity as being the result of the deformation of the space-time continuum. Sure.

Now let's suppose we have a box full of spinning gyroscopes. If we try to push the box, the gyroscopes are going to resist, right? And once you start them moving they're going to tend to continue to move in the same direction. Voilà, you have inertia.

The collective attraction of these energy balls for one another we sense as gravity.

I've proposed this theory in my *Cold Fusion* editorials, fully expecting to be dumped on for being so dumb. A couple of scientists have called, naming the energy balls "Green Balls." Well, at least they didn't suggest Green's Big Balls. But though the readership of the publication includes some of the world's top physicists, no one has dumped on me yet. They probably will.

Why cold fusion?

Not satisfied with going way out on a limb with my proposed solutions for inertia and gravity, I've been reading more books, looking for clues to what's happening to produce all that heat. The power of the vortices in my little energy balls could explain how the dread Coulomb barrier is overcome. This is a force that keeps two protons apart.

In my January editorial I had a section on alchemy today, recommending the book, "The Philosopher's Stone." Well, the more I thought about it, the more likely it seemed to me that what was happening in the cold fusion cells was hydrogen changing to helium, though lab tests have confirmed that not enough helium is produced to explain all of the heat generated. Okay, perhaps the lithium in the electrolyte is combining with two hydrogens to form beryllium and/or with four hydrogens to form boron. And why not also check and see if the palladium is combining with two hydrogens to form silver? It won't hurt to check for sodium too, which might be the result of lithium combining with one oxygen. Or palladium with oxygen to produce antimony. The universities of Illinois and Missouri are checking some used cell microspheres with mass spectrometers to see if there are signs of element transmutation. I'll be surprised and disappointed if they don't find I'm right on what's happening.

Each of these proposed transmutations would tend to release heat, easily explaining the excess heat generated by the reaction.

The media

The first sign of serious media attention to the recent cold fusion developments was the airing of a segment on Dr. Patterson on "Good Morning America." This was followed that evening on "Nightline" by a full half hour devoted to the Patterson cell. The main critic of cold fusion has been Prof. Huezinga of the University of Rochester, who put his scientific reputation on the line by publishing a book, "Cold Fusion, the Fiasco of the Century." The poor professor, faced with Dr. Patterson's success, sat there with his eyes closed or blinking most of the time, apparently wanting to hide, and stuttering about there being no detected radioactive products, so it couldn't be fusion. No, since it was impossible, he hadn't bothered to look into it. Figures.

Cover Photos

If you're handy with a camera, show me what you can do—let's see some interesting photos I might be able to use on the cover. Sure, antennas can be fascinating, and a hamshack with a zillion dollars worth of equipment can make us envious, so I'm not discouraging the tried and true. But that just tends to make *73* like the other ham rags, and we're *not*.

As old Uncle Don used to say, "Let's put on our thinking caps." You remember Uncle Don, right? Every night for years on the Mutual Network at 6 pm. Of course, he's better known today for something else he said. Anyway, let's see what you can

Continued on page 88

Debunking Some Myths

Continued from page 59

9. Impedance mismatches cause power reflections on the feedline. Assuming a loss-less feedline, a) all reflected power will be returned to and radiated by the antenna, and b) all received signal power will be returned to the receiver. However, if a mismatch between the receiver and feedline exists, the reflected signal power will be returned and re-radiated by the antenna.

10. High SWR in a coaxial transmission line does not create RF currents to flow on the surface of the outer braid. When the currents are of equal amplitude, even open-wire feedline will not radiate due to high SWR. The currents must remain balanced.

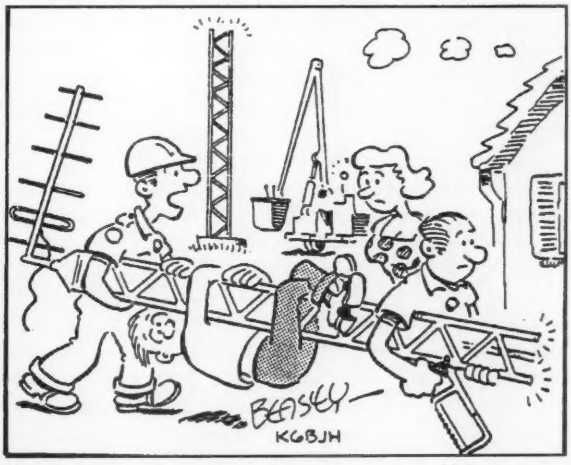
11. Loading coils (used to shorten antennas) provide the necessary inductive reactance to cancel the capacitive reactance. It is very easy, and very wrong, to believe that the coil is replacing the missing "length."

12. Using a balun transformer to transform (change) impedances to a transmitting antenna is often desirable. However, the balun must be operated within its power rating, or the ferrite core material may become saturated. A heated balun is the result of wasted, non-radiated RF energy.

13. A big antenna does not radiate more power than a small antenna. However, large antennas do confine the radiation into a much more directional pattern than a small antenna. The larger antennas, due to the concentrated directional capability, also receive or capture more signal than the smaller antennas.

14. When using a frequency meter to find the resonant frequency of an antenna, the meter should be connected at the antenna. Connecting the meter after a length of feedline measures the resonant frequency of the combination.

While it is fun to discuss antenna systems, we all need to make a conscious effort not to propagate falsehood—one operator was overheard telling another radio operator that his transmission line must have a 1:1 SWR because it lay perfectly flat on the ground and didn't have any bumps in it. I think he may have been equating impedance bumps to speed bumps!



Toon 3: *Sorry about the tower, ma'am—we couldn't pry your husband loose.*

Continued on page 88

Reprinted from the March 1967 issue of 73 Amateur Radio.

Edison—The Fabulous Drone

by J.L. Elkhorne

Was Edison really the great genius schoolbooks tell us he was? Or was he simply very diligent and hardworking?

The Great Man confided that he tried "everything" while working on inventions. When 10,000 experiments with a storage battery went down to failure, he said: "I have not failed. I have just found 10,000 ways that won't work."

He argued with Nikola Tesla, the brilliant Serbian engineer and scientist, telling him that AC electricity was a "waste of effort and money."

"Looks like a bunch of Chinese laundry markings," he remarked of his hired mathematicians' worksheets.

He said: "Genius is one percent inspiration and 99 per cent perspiration."

Most people think Thomas Alva Edison was perhaps the world's greatest inventor. But in comparison to his contemporaries, he was an inveterate fiddler, who scorned abstract work to tinker about with one failure after another.

Tesla observed of Edison's work methods: "If Edison had a needle to find in a haystack, he would proceed at once with the diligence of the bee to examine straw after straw until he found the object of his search." Tesla said further: "I was a sorry witness of such doings, knowing that a little theory and calculation would have saved him ninety per cent of his labor." Edison plodded along, content to improve on existing ideas, insistent on hand work over brain work, and often completely blind to the uses of his own great and original work. Of his first phonograph, he said: "Maybe we could use it for some sort of telephone repeater."

In later years he said of its first successful test: "I was never so taken aback in all my life. Everybody was astonished. *I was always afraid of things that worked the first time*."

Even after patent rights were issued to manufacturers, Edison claimed it was "just a fad, and would be completely forgotten in five years." As late as 1925 he would not concede that electronic phonographs were superior and maintained that T.A. Edison, Inc. would make an improved mechanical phonograph for long playing records.

Also in 1925 he noted that the 'radio craze' would soon pass. "The present radio...is certainly a lemon. It will in time cure the dealer of any desire to handle any kind of radio." He also insisted that the public would not stand still for having to listen to the programming the broadcasters provided.

In 1926, though very hard of hearing, Edison tested an electronic phonograph perfected by Bertil Hauffman, a Swedish engineer, at the Edison Laboratory. Edison found the reproduction 'distorted and terrible' and ordered that Hauffman be fired. Son Theodore, director of the works, arranged for Hauffman to work thereafter in a part of the laboratory that Edison was not likely to visit.

Edison once said that he enjoyed his deafness because it permitted him to concentrate. Though his progressive deafness made him almost stone deaf in elder years, one wonders if the affliction also allowed him to ignore criticism in earlier times.

Another facet of the Edison myth is the famous story of his sleeping only four hours a night. John J. O'Neill reports in his biography of Tesla: "It was a regular practice with Edison to sit down in his laboratory and doze off into a three-hour nap about twice a day."

Edison was strangely averse to theoretical work himself; as a thinker, he was second rate—as an administrator, second to none. The 'Wizard of Menlo Park' hired batteries of mathematicians and physicists, laughed at their theoretical approach, but utilized their results.

When the young genius Nikola Tesla came to this country, he had a letter of introduction to Thomas Edison, four cents in his pockets, and the key to alternating current electricity—today's housepower—locked in his mind. Edison offered him a meager eighteen dollars a week, providing he never spoke of AC.

Tesla proved himself an able engineer and inventor, regularly submitting improvements for Edison equipment. When Tesla suggested research toward improved dynamo manufacture, Edison told him: "There's fifty thousand dollars for you in it—if it works." Inside the week, Tesla presented the design. When he finally had to ask about the money, Edison grinned and said: "I guess you just don't understand our Yankee humor."

Tesla quit. Some months later, he had interested investors in his ideas for AC, constructed working models, and applied for a patent. The U.S. Patent Office responded that the ideas contained in the original patent application were so far-reaching that no less than forty would cover them!

George Westinghouse, industrialist and inventor himself, offered Tesla one million dollars for the rights and the Westinghouse Electric Company was formed. This was prologue to the biggest battle of the 19th century: a technological war in which Thomas Alva Edison was the prime antagonist.

Edison had recently spent two million dollars with his DC system in New York City. The financial threat posed by Westinghouse and Tesla could not be ignored. Although Edison had said AC was "a waste of effort and money," he found his system impractical to produce voltages higher than 220, as the dynamo commutators heated badly. Too, line losses necessitated either large, expensive conductors or power stations spaced every mile or so.

DC power left the generating plant at about 120 volts, the users closest to the plant had the brightest lights, sometimes so much so that bulbs burned out frequently. Conversely, those at the end of the line had light hardly better than candlepower, because of the voltage drop along the line. With Tesla's AC system, alternating current could be transmitted equally to home or factory, with negligible power loss in the lines.

Edison wrote: "Just as certain as death Westinghouse will kill a customer within six months after he puts in a system of any size...it will never be free from danger."

Westinghouse argued that of thirty deaths by electricity in 'recent' years, sixteen were from 'safe' DC circuits, and none from Westinghouse equipment. During one period Edison lost about a workman a month with 'safe' direct current and almost burned down the fashionable Vanderbilt home on Fifth Ave. A fire started when metallic-threaded draperies shorted out the wiring which had been placed behind it. Mrs. Vanderbilt returned home to find a confusion of firemen, assistants and Edison himself. Learning that there was a generating plant in her cellar, she became 'hysterical' and declared she could not live over a boiler. "We had to take the whole thing out," Edison ruefully remarked.

To sway public opinion in the "battle of the currents," Edison and Charles Batchellor—ironically the man who gave Tesla the letter of introduction to Edison—demonstrated the horrible danger of alternating currents by electrocuting cats and dogs, using a one kilovolt generator. They paid eager schoolboys twenty-five cents a head for all the animals they could deliver. It is said that the house pet population around West Orange stood in danger of being annihilated. During one of these edifying illustrations for guests, Batchellor lost his hold on the dog he was about to electrify and himself received the shock. As he put it later: "The sensation was of an immense rough file thrust through the quivering fibers of the body."

After this, Edison published an article saying in part: "I have not failed to seek practical demonstration...I have taken life—not human life—in the belief that the end justifies the means." Yet in the final battle of this strange war, Edison seemingly reversed his opinions and requested permission to install AC equipment in upstate New York. Westinghouse hastily agreed.

It might be said that the news of the installation came as a shock to Westinghouse—it was the first electric chair. The New York State Legislature had adopted a statute in 1888 to provide for capital punishment by electrocution. H. P. Brown, a former research expert for Edison, supervised the installation of the 'hot squat' for the Edison General Electric Company.

On August 6, 1890, convicted murderer William Kemmler was to be executed. The first attempt at death by legal electrocution was a failure, as the electric force was too weak. The unfortunate man was led away. After quick modifications to the chair, "The miserable work was perforce done again, resulting in a spectacle much worse than hanging."

A frantic Westinghouse recouped by obtaining the contract to provide power for the Columbian Exposition of 1893. Tesla had his own exhibit there, where he mystified fairgoers with his scientific marvels. The climax of the many performances was the passing of one million volts of AC through his body to melt a copper plate. It was not high voltage that killed, he maintained, but the destructive heating of high currents. High amperage DC could and did kill as readily as AC. While working up his demonstrations, he discovered the medical principle of diathermy.

The public was won over to AC and in 1895, Tesla harnessed Niagara Falls. His powerhouse was completed, providing AC for Buffalo, New York, twenty-two miles away. It was hailed as the greatest engineering achievement in the world to that date.

In 1896, a mysterious cigar-shaped airship was seen by hundreds of people over San Francisco Bay, and subsequently was reported in successive eastward sightings. A New York *Herald* reporter obtained this statement from Edison, who disclaimed any knowledge of the never-identified craft: "I prefer to devote my time to objects of commercial value. At best airships would only be toys." A few years later, he was congratulating Alberto Santos-Dumont for inventing powered flight, not recognizing the achievement of the Wright brothers.

The Edison Effect—the expulsion of particles from a heated filament—grew from experiments with the light bulb. Edison found that bulb life was shortened by the deposit of carbon from the filament. He sketched in his notebook the first two-element vacuum tube as a solution to the problem, having found that current would flow into the second element. This forerunner of today's diode was patented but never used, and the patent lapsed.

With the diode, his discovery of the 'etheric force' and a subsequent patent of wireless transmission based on electrostatic induction, he had in his grasp the elements of a complete radio system several years before Hertz demonstrated the existence of radio waves. Later in life, he said that it was a pity he had not seen any connection between them.

His first major invention, the carbon button microphone, is virtually the same today; it improved an existing idea, the Bell device. Edison came, as it were, into a technological vacuum, purifying existing and imperfect concepts, and applying much of the random electrical science accumulated over fifty years. He did enough that he could well say in later years his productivity brought him "awards by the quart." He patented over 1,100 inventions and gained a vast reputation while his more brilliant and less understood contemporaries are all but forgotten.

George Westinghouse himself patented over 400 inventions in his lifetime and founded 60 companies.

Charles Proteus Steinmetz, whom Edison liked "because he never spoke of mathematics to me," published the law of hysteresis when he was only 27, went on to produce artificial lightning and delve into higher mysteries. He is little known today.

Nikola Tesla, besides giving the world AC, demonstrated radio control before the turn of the century, developed a working system of broadcast power, lighted his laboratories with wireless fluorescent lights in 1889, and had over 700 patents to his credit when he died in 1943. Yet he is the forgotten man of electrical science.

Edison, the Great Man, reigns supreme. 73

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SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the April issue, we should receive it by January 31. Provide a clear, concise summary of the essential details about your Special Event.

APR 6

AIKEN, SC The Aiken Contest Club will sponsor the 2nd Annual Aiken Hamfest and Computer Show at Aiken County Jaycee Fairgrounds, US Hwy. 1 North, 4 mi. South of I-20. Doors open Sat. at 9 AM. Set up Fri., 6 PM–9 PM; Sat., 6 AM–9 AM. VE Exams, Reg. at 10 AM–Noon at the Jaycee Hut. Testing at 12 Noon. Walk-ins only, bring original and copy of your license, any CSCE's, and 2 ID's, 1 w/photo. There will also be a used gear test table. Talk-In on 147.285(+), 145.170(-) and 443.400 (+, 107.2 Hz). Contact *Doug Glass AC4WW, 127 Trailwood Ave., Aiken SC 29803-7602. Tel. (803) 648-4754.*

LONGMONT, CO The Longmont ARC will sponsor its Annual LARCFEST at the Boulder County Fairgrounds, Hover and Nelson Rds., 8 AM–3 PM. VE Exams at 1 PM. Talk-In on 147.27/.87, and 146.52. Write with SASE to *LARCFEST, L.A.R.C., P.O. Box 86, Longmont CO 80502-0086.*

APR 12–13

TUPELO, MS The Tupelo ARC and Booneville ARC will sponsor the Northeast Mississippi Hamfest and Computer Expo on Apr. 12th, 6 PM–9 PM, and Apr. 13th, 8 AM–5 PM, at the Tupelo Furniture Market Complex, Coley Rd. Flea Market. VE Exams. Contact *Jack Ellis KI5QV, Rt. 4, Box 198-B, Tupelo MS 38801. Tel. (601) 842-7255.* Talk-In on 147.38(+); Ragchew on 147.24(+).

APR 13

CENTRAL VALLEY, NY The supporters of the Northeast Connection are scheduling a major Fox Hunt, to be held at multiple locations in Orange County. The first three hunters to locate the fox will receive a valuable prize. All other participants will receive certificates of appreciation. You need not be a supporter of Northeast Connection to participate. For more details contact *Sid KB2RNQ, or write to P.O. Box 551, Central Valley NY 10917.*

FREDERICKSBURG, PA The Appalachian AARG will hold their 8th Annual Hamfest and Computer Show at Northern Lebanon H.S., beginning at 8 AM. VE Exams on-site, pre-reg. requested; contact *Roger Engle WN3U, 981 Radio Rd., Elizabethtown PA 17022. Tel. (717) 367-2230.* For tables, contact *AARG, 105 Walnut St., Pine Grove PA 17963, Tel. (717) 345-3780;* or *Lanny Hoffman KD3TS, 337 N. 19th St., Lebanon PA 17042. Tel. (717) 274-2148.*

APR 14

BRIGHTON, CO The Aurora Rptr. Assn. will hold its 14th Annual Swapfest at the Adams County Fairgrounds, 9755 Henderson Rd., 8:30 AM–2 PM. Contact *Judi WD0HNP, (303) 450-6910;* or *Jan KA7TYU, (303) 699-1944;* or write to *Aurora Repeater Assn., P.O. Box 39666, Denver CO 80239.*

FRAMINGHAM, MA The Framingham ARA will host its Spring Flea Market and Exams at Framingham H.S., A Street. Doors open for buyers 9 AM–1 PM. Set up is at 8 AM. To reserve tables, contact *Martin Bayes AA1ON, (508) 435-0564,* and send check payable to FARA, to *FARA, P.O. Box 3005, Framingham MA 01701.* To register for exams, send a check for $6.05, payable to ARRL/VEC, to *Dick Marshall WA1KUG, 37 Lyman Rd., Framingham MA 01701.* Exam walk-ins will *not* be accepted after 10 AM. Talk-in on 147.15 Rptr.

MADISON, WI The Madison Swapfest and Computer Fair, sponsored by Madison Area Rptr. Assn. WB9AER, will be held starting at 8 AM at Dane County Expo Exhibition Hall. Talk-in on 147.15 Rptr. Sellers and exhibitors w/ 6 or more tables set up at 3 AM. All other sellers set up at 6 AM. Exhibitors, contact *MARA,* 24 hr. answering machine, *(608) 245-8890.* Make reservations before April 6th. Make checks payable to MARA, and mail to *MARA, Box 8890, Madison WI 53708-8890.*

RALEIGH, NC The Raleigh ARS will present its 24th Hamfest, ARRL NC State Convention and Computer Fair in the Jim Graham Bldg., NCS Fairgrounds, Sun., 8 AM–4 PM. All activities indoors. VE Exams, pre-reg., (919) 847-8512. Dealers, contact *Rollin Ransom NF4P, 1421 Parks Village Rd., Zebulon NC 27597. Tel. (919) 269-4406.* Talk-In on 146.04/.64.

APR 19–21

VISALIA, CA The 1996 Internat'l DX Convention will be hosted by the Southern Calif. DX Club, and held at the Visalia Holiday Inn. Reg. includes two hosted Cocktail Parties, Sat. Banquet, Sun. Breakfast, all programs, etc. For more info, contact *Rick Samoian WB6OKK, (714) 993-0713.* Send registration requests/payments to *Don Bostrom N6IC, 4447 Atoll Ave., Sherman Oaks CA 91423.*

APR 21

ARTHUR, IL The Moultrie AR Klub will hold their 34th Annual Hamfest at the Moultrie/Douglas County Fair Grounds, 8 AM–1 PM. Flea Market. Forums. Talk-In on 146.055/.655 and 449.275/444.275. Contact *M.A.R.K, P.O. Box 91, Lovington IL 61937. Tel. days, (217) 543-2178; eves., (217) 873-5287.*

BOOTHWYN, PA The Penn-Del ARC will hold their Annual Hamfest 8 AM–2 PM at the Nur Temple on Route 13 in New Castle DE. Set up at 6 AM. No advance tickets. Tables by reservation only, with payment to *Penn-Dell Hamfest 96, P.O. Box 1964, Boothwyn PA 19061.* Certified Skywarn Spotter Training Class, ARRL Forum at 11 AM. Contact *Hal Frantz KA3TWG, (302) 798-7270.*

SONOMA, CA The Valley of the Moon ARC, WB6DWY, will hold its Annual ARRL Hamfest 8 AM–3 PM at the Sonoma Veteran's Memorial Bldg., 126 First St. West. Walk-in VE Exams, reg. at 9 AM, tests at 10 AM. Electronics Swap Meet, set up at 7 AM. Forum will include an operating QRP station and display of home-built equip; an AMSAT booth w/operating Earth station; a beginner's Fox Hunt, and more. Station WB6DWY will operate on 20 and 40 meters at 7045, 7250 and 14250 MHz (+/-) during the Hamfest. QSLs can be sent to *Darrel Jones WD6BOR, 358 Patten St., Sonoma CA 95476.* Please include an SASE. Talk-In on 145.35(-) PL 88.5. For info, call *Darrel WD6BOR at (707) 996-4494.*

APR 27

DES MOINES, IA A Hamfest will be held by the Des Moines Radio Amateur Assn. at Iowa State Fairgrounds Tourism Bldg., 8 AM–1 PM. Talk-In on 146.94. VE Exams. Contact *Duane Bower WB0UCY, 207 Diehl Ave., Des Moines IA 50315. Tel. (515) 287-6542* after 5 PM.

FLATWOODS, WV The 3rd Annual Central WV Hamfest, sponsored by the Pioneer ARA will be held 9 AM–3 PM at Braxton County H.S. Motels available. Dealers welcome. Talk-In on 145.29, 146.655. Contact *Ed Messenger N8OYY, (304) 462-5312;* or *Vic Moyers N8MJQ, (304) 462-7885;* or write to *PARA/HAMFEST, P.O. Box 301, Glenville WV 26351.*

HURON, SD The Huron ARC will sponor their 3rd Annual Amateur Electronics Swapfest 8 AM–3 PM at the Nat'l. Guard Armory, SD State Fairgrounds. Flea Market set up at 7 AM. VE Exams at 9 AM. Talk-In on 146.22/.82. Contact *Lloyd Timperley WB0ULX, P.O. box 205, Huron SD 57350. Tel. (605) 352-7896* eves.

SYRACUSE, NY The Liverpool Amateur Rptr. Club will hold a Hamfest at New York State Fairgrounds 7:30 AM–4 PM. Demos, Flea Market, Exhibits. Talk-In on 146.91(-). Contact *Larry Taft AA2KK, (315) 668-8219* eves; or *LARC, P.O. Box 103, N. Syracuse NY 13212; or N2TKX@AOL.COM.*

APR 27–28

MONROE COUNTY, MI The Radio Active Comm. Club of SE MI, and the Maumee Valley Monitoring Assn., will host their 1st annual weekend of Transmitter Hunting, in the Monroe area. Local participants should contact *Mark N8IQX at (313) 582-0896* for info and reg. Out-of-towners, please send an SASE to *Mark Drolias, 15104 Prospect, Dearborn MI 48126.*

APR 28

ATHENS, OH The 17th Annual Hamfest of the Athens County ARA will be held 8 AM–3 PM at the City Rec. Center. Take the East St. exit from US Rte 33 or US Rte 50. Indoor space by advance reg. only; contact *Drew McDaniel W8MHV, 61 Briarwood Dr., Athens OH 45701. Tel. (614) 592-2106, 6 PM–9 PM EST; Internet: dmcdaniel1@ohiou.edu.* For general info, write to *Carl J. Denbow KA8JXG, 63 Morris Ave., Athens OH 45701-1939; Internet: cdenbow1@ohiou.edu; or packet: KA8JXG@KA8DRR.OH.US.NA.* Talk-In on the Club Rptr. at 145.15(-).

CHICAGO, IL The Chicago ARC will present a Ham Auction at the DeVry Inst. of Tech., 330 N. Campbell Ave., starting at 12 Noon. All items auctioned are subject to a 10% donation. If purchased back by seller, then 5% will be due. Bring TVs, VCRs, 2-way radios, oscilloscopes, meters, signal generators, transmitters, receivers, transceivers, amplifiers, tuners, antique radios, etc. For more info, call *Dean at (708) 331-7764*, morning or eve. During the day, call *George, (312) 545-3622.*

GROSSE POINTE WOODS, MI The SE Michigan ARA will conduct its 34th Annual Hamfest/Swap-N-Shop/ Computer Show at Grosse Pointe North H.S., 707 Vernier Rd., 8 AM–2 PM. ARRL Forum. VE Exams. Talk-In on the SEMARA Rptr, 146.74(-). Contact *Thomas Orlicki N8HLY, P.O. Box 646, St. Clair Shores MI 48080-0646. Tel. (313) 527-3497. E-mail: STOSH@NVISION.COM.*

MAY 4

ETOBICOKE, ONT., CANADA The Annual Spring Hamfest and Flea Market sponsored by the Skywide ARC will be held at Westway United Church, 8 Templar Dr., 9 AM–1:30 PM. Vendors set up at 8 AM. Talk-In on 146.985 or simplex 146.52. For info, call *Derrick Poulter VE3ZXD, (416) 243-2020;* or *Went Wheatley VE3WAY, (416) 233-6648.*

MAY 4–5

ABILENE, TX The Key City ARC will sponsor the ARRL West Texas Section Convention and Hamfest at the Abilene Civic Center, 8 AM–5 PM Sat., and 9 AM–2 PM Sun. VE Exams. Pre-reg. must be received by Apr. 30th. Talk-In on 146.160/760. For info and reservations, contact *Peg Richard KA4UPA, 1442 Lakeside Dr., Abilene TX 79602. Tel. (915) 672-8889.*

MAY 5

SANDWICH, IL The Kishwaukee ARC Hamfest '96 will be held at Sandwich Fairgrounds, starting at 8 AM. Set up at 6 AM. Talk-In on 146.730(-) Rptr.; 146.52 simplex. Advance tickets $5, tables $10. Make checks payable to KARC, and SASE to *Howard WA9TXW, Attn: Hamfest, P.O. Box 264, Sycamore IL 60178.*

YONKERS, NY A Giant Electronic Flea Market will be held at Lincoln H.S. by the Metro 70cm. Network. Time: 9 AM–3 PM, rain or shine. Set ups at 7 AM. VE Exams. Talk-In on 449.425 MHz PL 156.7; 223.760 MHz PL 67.0; 146.910 Hz; and 443.350 MHz PL 156.7. CAll *Otto Supliski WB2SLQ, (914) 969-1053.* Mail paid reservations to *Metro 70 CM Network, 53 Hayward St., Yonkers NY 10704.*

MAY 11

MANITOWOC, WI The Manitowoc County Expo Ctr. is the chosen site for Mancorad Radio Club's1996 Hamfest and Computer Swapfest. The event starts at 8 AM. Flea Market (amateur, computer, electronic). VE Exams at Silver Lake College (Hwy. 151); test reg. closes at 9 AM. Camping (414) 683-4378. Dealer set up Fri. night till 10 PM, or early Sat. morning. Talk-In on 146.01/ .61 or 147.03(+). Contact: SASE to *Mancorad RC, P.O. Box 204, Manitowoc WI 54221-0204;* or call *Red, (414) 684-9097 days; or Glenn, (414) 684-7096,* any time.

SPECIAL EVENT STATIONS

APR 1–30

DAYTON, OH The Farout ARC will operate WB8SMC 0001 UTC Apr. 1st-2359 UTC Apr. 30th. to commemorate the Bicentennial of the founding of Dayton OH. Freq.: 25 kHz up from lower Gen./Nov. PH/CW band edges (op's choice). For a QSL card, send an SASE to *Charlie Cotterman, c/o WB8SMC, 26 Mello Ave., Dayton OH 45410-2119.*

APR 6–7

PISCATAWAY, NJ The Piscataway ARC will operate member stations, signing /VOA, from 0000Z–2400Z each of the two days. It will commemorate the World War II operation of the "Voice of America" relay station, WBOU. Freq.: CW–Novice portions of the bands; Phone–lower third of the General portion of the 75–15 meter bands and the Novice portion of the 10 meter band. RTTY operations on 80, 40, and 20 meters. For a certificate, send QSL and SASE to the station worked.

APR 14

OTTAWA, ONT., CANADA The Ottawa Valley Mobile RC will operate an SE Station to celebrate the 1st Anniversary of the opening of the amateur radio station/exhibit at the Museum of Science and Tech. Freq.: SSB–3860, 7260, 14260, and 147.300(+) FM, depending +/- QRM. Times are 1400Z–2200Z (0900–1700 local). For your choice of a certificate or QSL card, send an SASE to *VE3JW, Box 5530, Stn 'F', Ottawa ONT, Canada K2C 3MI.*

APR 14–27

TOFIELD, ALBERTA, CANADA Special Event Station VA6SG will operate to celebrate the 4th Annual Snow Goose Festival. Freq: SSB–160, 80, 40, 20, 15, 10 meters, and 146.52 FM (Talk-In Freq.). *QSL via VE6WPY CB* . Address including two green stamps or three IRCs to cover postage. Allow 6 weeks for delivery of certificate.

APR 20–21

AMERICUS, GA The Sumter Co. ARC will operate W4UFD 1400Z–2000Z each day, to celebrate Charles Lindburgh Day. Freq.: 7.250, 14.303, 21.305. For a QSL, send QSL and SASE to *C.T. Royal WD4EIK, P.O. Box 195, Americus GA 31709.*

APR 21

SONOMA, CA The Valley of the Moon ARC will operate WB6DWY, 1700 UTC–2200 UTC to commemorate the City of Sonoma and the Valley of the Moon's rich historical heritage. The station will operate in conjunction with the Valley of the Moon ARC's annual ARRL Hamfest. Operation will be on 20 and 40 meters at 7045, 7250, and 14250 MHZ (+/-) during the Hamfest. QSL to *VOMARC, 358 Patten St., Sonoma CA 95476.* Send an SASE for the event Certificate.

APR 26–27

THOMASVILLE, GA The Thomasville ARC will operate W4UCJ 1700Z–2300Z Apr. 26th, and 1100Z–2000Z Apr. 27th, to commemorate the 75th Annual Rose Festival. Operation will be in the lower portion of the General 60, 40, 20 and 15 meter phone subbands, and the Novice 10 meter phone subband. For a certificate, send QSL and a 9" x 12" SASE to *TARC/Rose Festival Station, P.O. Box 251, Thomasville GA 31799.*

APR 27–28

GREEN VALLEY, AZ The Green Valley (AZ) ARC will operate W7PU 1600Z Apr. 27th–2300Z Apr. 28th at the Green Valley Titan Missile Museum, a Historical Nat'l. Monument. Operation will be on 3.860, 7.230, 14.250, 21.330, 28.450 and 145.290/144.69. For a certificate, send QSL and a 9" x 12" SASE to *GVARC, 601 N La Cañada, Green Valley AZ 85614.*

MAY 3–5

MARSHFIELD, MA The Whitman ARC will operate K2BSA/1 at the Old Colony Council Boy Scout Camporee from May 3rd at 1200 hrs.–May 5th at 1200 hrs, on 14.285 and 18.140 +/ - QRM. Please, all QSL replys *must* be sent with an SASE to the *Whitman ARC, P.O. Box 48, Whitman MA 02382.*

MAY 4-5

GENOA, CO The Ten-Ten Internat'l Contest will sponsor their CW QSO Party May 4th and 5th. For a complete set of rules, sample log sheet and sample dupe sheet, send a #10 SASE to *Don Zielinski K0PVI, 10-X Intl. Contest Manager, c/o The Bighorn Museum of Amateur Radio, P.O. Box DX, Genoa CO 80818-0119.*

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Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad. This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

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PROPAGATION

Number 87 on your Feedback card

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

April is expected to provide some very interesting conditions for DXers. The Poorest days (P) are expected to be the 8th and 21st–22nd. The Best days (G) are expected to be the 1st, 4th–5th, and 25th–27th. The 10th–13th, 16th–17th, and 29th are expected to provide only Fair (F) conditions, while the remaining days should be trending, as shown on the chart. Sunspot activity may also be increasing with the imminent onset of Cycle 23.

Intermittent daytime thunderstorms will provide the occasional QRN to wipe out weak signals just when you need confirmation of a report or call sign! However, you'll note that Good, Fair, Fair-to-Good, and Good-to-Fair conditions should be present on 23 days, leaving only 7 days to worry about. You should be able to score big-time DX in April, particularly in view of the overall seasonal improvement in solar flux levels. Good luck!

10–12m

Occasional trans-equatorial F-2 layer openings during daylight hours, with 12 meters to show greater signal strengths.

15–17m

Circuits from the northern hemisphere to Africa and South America should open on *good* days, and daytime short-skip openings will also be present on *good* days. Performance of these bands will be sporadic, but on some days will sparkle.

20m

This will be your most consistent band of choice for DX opportunities from sunrise until after sunset. Expect DX from northern to southern hemispheres with decent signal strengths on most days, and short-skip openings to 2,000 miles as well.

30–40m

DX from just before sunset until shortly after sunrise will provide enjoyment on the *good* days. However, be aware of seasonal QRN interfering with weak signals. Signals peak to the east before midnight and peak to the west before dawn. Daytime short-skip will be good out to 1,000 miles or so.

80 and 160m

DX during hours of darkness will be available, but not as prevalent as during the winter months. QRN may become a problem for weak signal reception. Some daylight short-skip on 80 will be present, but none at all on 160. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R								20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

Where 10m is shown, also check 12m. Where 15m is shown, check 17m too. Where 20m is shown, be sure to look at 17 as well. Always check the bands above and below the indicated bands for possible openings to the areas shown. Remember that DX is where you find it, and not always where it is predicted to be.

April 1996

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G	2 G-F	3 F-G	4 G	5 G	6 G-F
7 F-P	8 P	9 P-F	10 F	11 F	12 F	13 F
14 F-G	15 G-F	16 F	17 F	18 F-G	19 G-F	20 F-P
21 P	22 P	23 P-F	24 F-G	25 G	26 G	27 G
28 G-F	29 F	30 F-G				

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Sunrayce

Oops!

We hope you enjoyed "Satellites, Weather Imagery, and Sunrayce '95" by James R. Buchanan K8WPI. We do have a couple of things to clear up—the specter mentioned on page 10 was Rod *Serling*, not Sterling; (###25) should have been (>25); and the 2 wavelengths at which the author tailgated the tractor-trailer should actually have been *.2*; quite a difference in anxiety ratio there!

IMPORTANT SAFETY NOTICE

Alert reader Calvin Hashi N6SSW sends this warning of possible Fire Hazard:

In "Simple Mobile Protection" published in January's *73* the author states "...the relay I used is one commonly used in mobile two-way radio installations." He adds "I've seen similar relays for sale at auto accessory shops as horn-relay replacements."

DO NOT USE HORN-RELAY REPLACEMENTS!

In Calvin's own words, "A horn-relay is designed for an intermittent (not continuous) duty-cycle. A few years ago, I tried to use a horn-relay for continuous duty, only to have it overheat (the relay actually started smoking). A much better choice (for about $5.00) would be to use a 20–amp continuous-duty relay that is used for auxiliary automotive lamps (like fog lights) that you might find in a four-wheel drive accessory shop. *The important thing is to use a relay that has a continuous-current rating of 20 amps or more*.

We join Calvin N6SSW in hoping no one's car has caught fire because of a horn-relay!

Authors Please Note

Superscripts and symbols often become garbled in electronic transfer. Please send a hard copy for reference along with your electronic submissions. (FAX is 603-924-8613.) TNX from 73 editorial staff.

NEVER SAY DIE

Continued from page 81

do in the way of some creative ideas for the *73* covers. Surprise me.

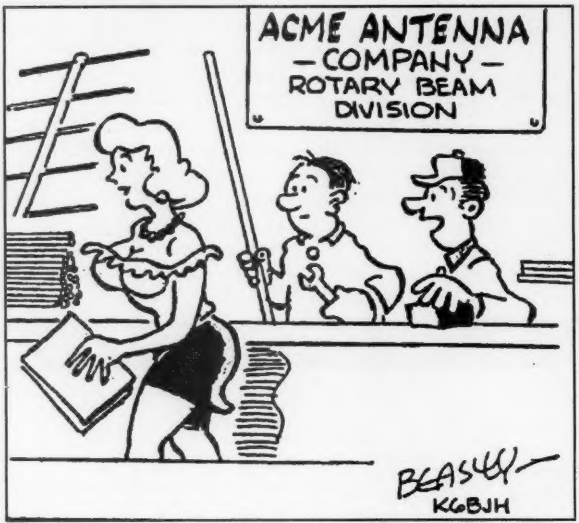
When you're planning the shot I hope you'll remember that the cover is vertically polarized, in case you've missed noticing it. And don't forget to leave some unimportant (picturewise) space along the top for the magazine logo and space for a few article teasers somewhere.

Yes, of course, despite the incredible fame your amazingly creative photo will achieve, I will still manage to eke out some reward money. And just to make sure your fellow hams will be in proper awe of your genius, I'll include your photo and credit on the table of contents page.

One note: the family dog with earphones, sitting at your ham rig and captioned "CW Hound," will not the mustard cut. Another note: 35mm, if you use a tripod, can hack it, but you'll get much better results with a 6x7 cm camera. ■

Debunking Some Myths

Continued from page 81



Toon 4: *I think the boss hired her because of her great front–to–back ratio...*

See pages 61 and 62 for lists of available Radio Bookshop books.

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TNX FER QSO. 73      ← Incoming data
█                    ← Outgoing data appears here
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